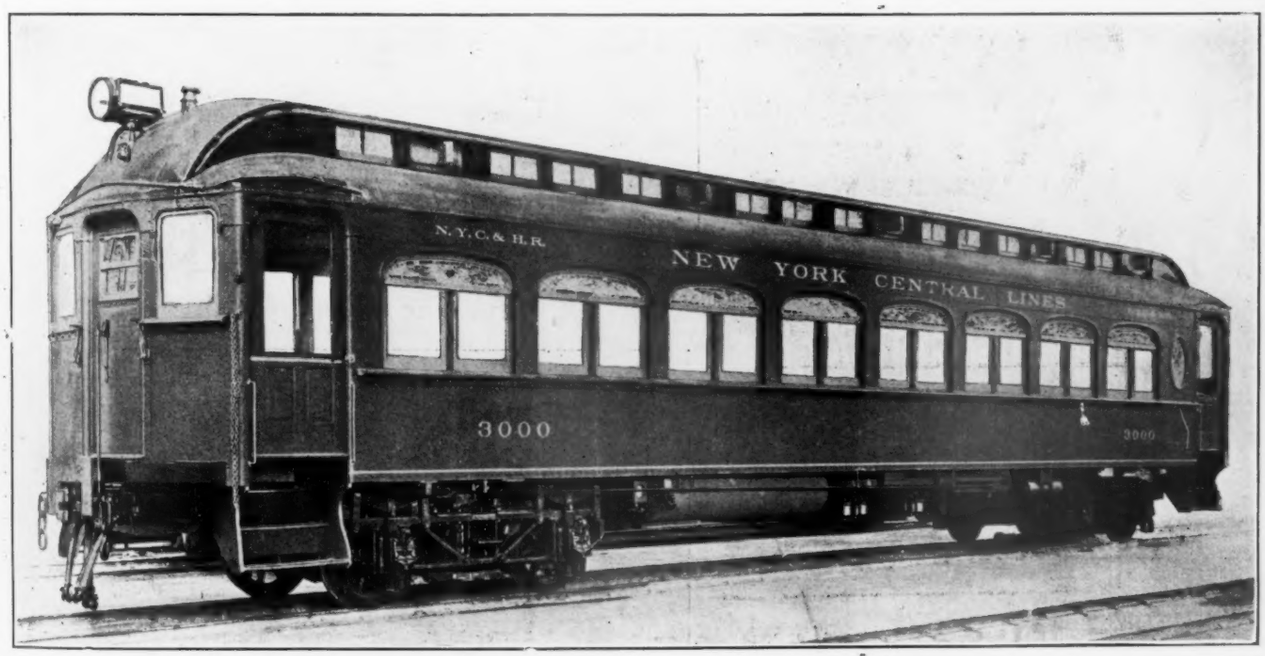
(Established 1832).
AMERICAN ENGINEER AND RAILROAD JOURNAL.
MARCH, 1907.

STEEL PASSENGER CAR.

NEW YORK CENTRAL & HUDSON RIVER R. R.

In connection with the electrification of the Grand Central terminal, New York, the all steel type passenger car for use in suburban service was adopted by the New York Central and Hudson River R. R. One hundred and twenty-five of these cars have been built and delivered by the American Car & Foundry Company, and some of them have been in regular service during the past two months. The car bodies were designed by the American Car & Foundry Company, the railroad company's mechanical and electrical departments arranging the general floor plan of car and the layout of electrical apparatus, brake rigging and wiring. They are arranged for operation in trains by the multiple unit system, over the electrified section of the line, all of this order being motor cars. A later order of 55 cars of similar design, which will not be equipped with motors, has been made and is now being delivered.



STEEL PASSENGER CAR—NEW YORK CENTRAL & HUDSON RIVER RAILROAD.

These cars have the distinction of being the first non-inflammable passenger coaches ever constructed in this country for use on a steam railroad. Each car is mounted upon one motor and one trailer truck, the motor truck being fitted with two 200 h.p. motors driving each axle by means of gears. Both the motor and trailer trucks were thoroughly described and illustrated in this journal in the issue of May, 1906, page 166, and reference should be made to that description for the features of these very interesting all steel trucks.

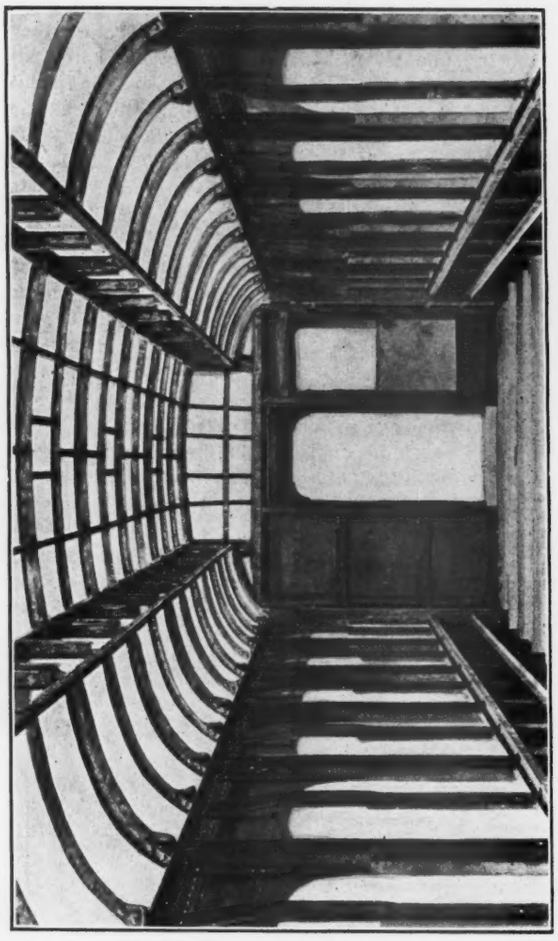
The car body comes within the classification of "all steel," since the very slight amount of wood used is for fastening a portion of the interior finish and does not in any way enter into the framing or the structural part of the car. Furthermore all the inflammable material used has been thoroughly fireproofed and the wood is in all cases encased in metal, which prevents the possibility of splinters in case of a very improbable collapse of the body. The car measures 48 ft. 11⅝ ins. in length inside of the body and is 60 ft. in length over the buffers. The height from rail to top of roof is 13 ft. 9½ ins. The width over side sills is 9 ft. 8¾ ins.

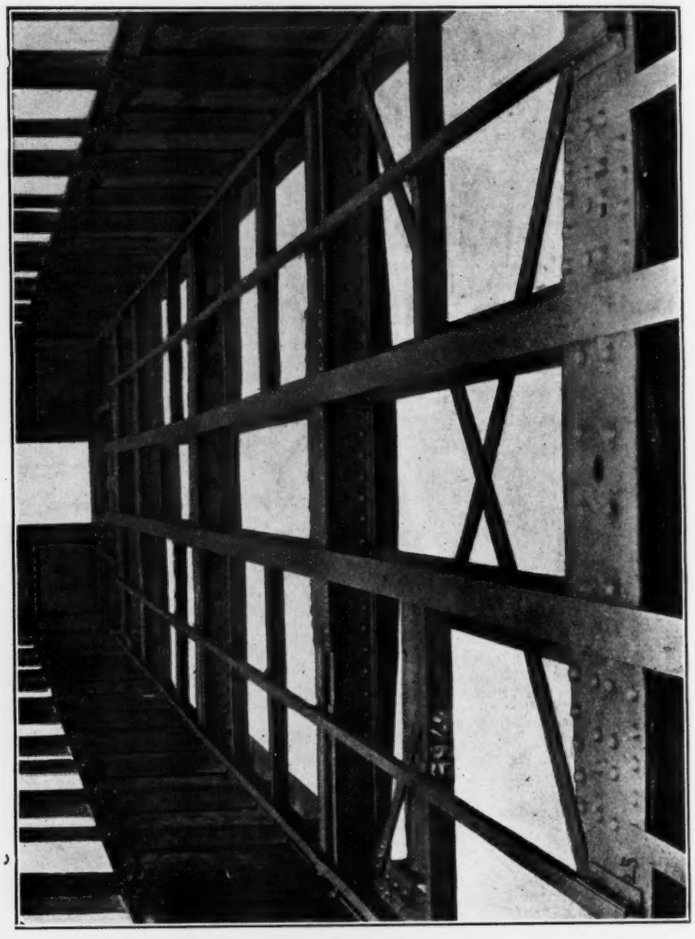
The original idea when this project was first taken up was to build a car which could be operated through the subway of the Interborough Rapid Transit Company, connection to which could easily be made at the Grand Central Station, but it was found that such a car would be very restricted in clearance dimensions, and since these cars are operated over divisions up to 40 miles in length, it is necessary to provide more comfort and convenience than such restricted clearances would allow, hence the car built conforms in both clearances and appearance to the standard passenger car of the railroad. It is provided with toilet facilities, good ventilation, and the windows are so constructed that they can be raised to the full height, giving an unobstructed view to a seated passenger. The exterior of the car is painted the standard color, a deep olive green, and lettered and striped in gold to conform to the present passenger equipment. The interior has been painted a dark green relieved by gold and white stripes and light colored head lining.

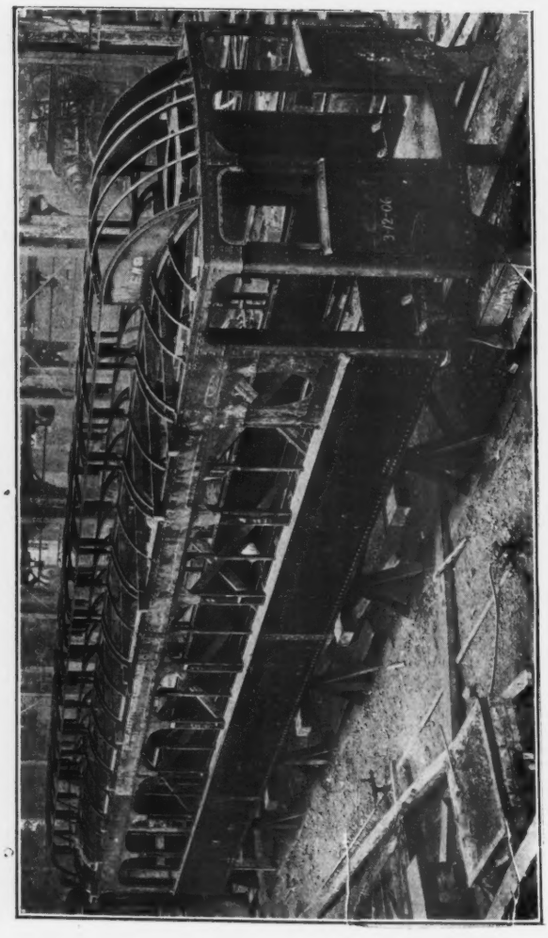
The wide vestibules have liberal dimensions length-wise, giving an unusually wide side door for the purpose of facilitating the loading and unloading of the car. The doors at the end of the car body are also made unusually wide for the same purpose. These cars will be operated in connection with raised platforms in some cases, and the vestibule trap door of pressed steel has been made to project below the side door, its outer edge being on a line with the side sheathing. Both the side doors and the end door in the car body slide into pockets suitably arranged, and the vestibule end door swings inward and incloses the motorman's control apparatus. A system of levers on the Pitt system permits the opening and closing of the side doors from a point between the cars outside the vestibules. Steps of steel provided with safety treads have been installed for use at stations where raised platforms have not been built.

The illustrations show the construction so clearly that little additional description is required. The general scheme of con-

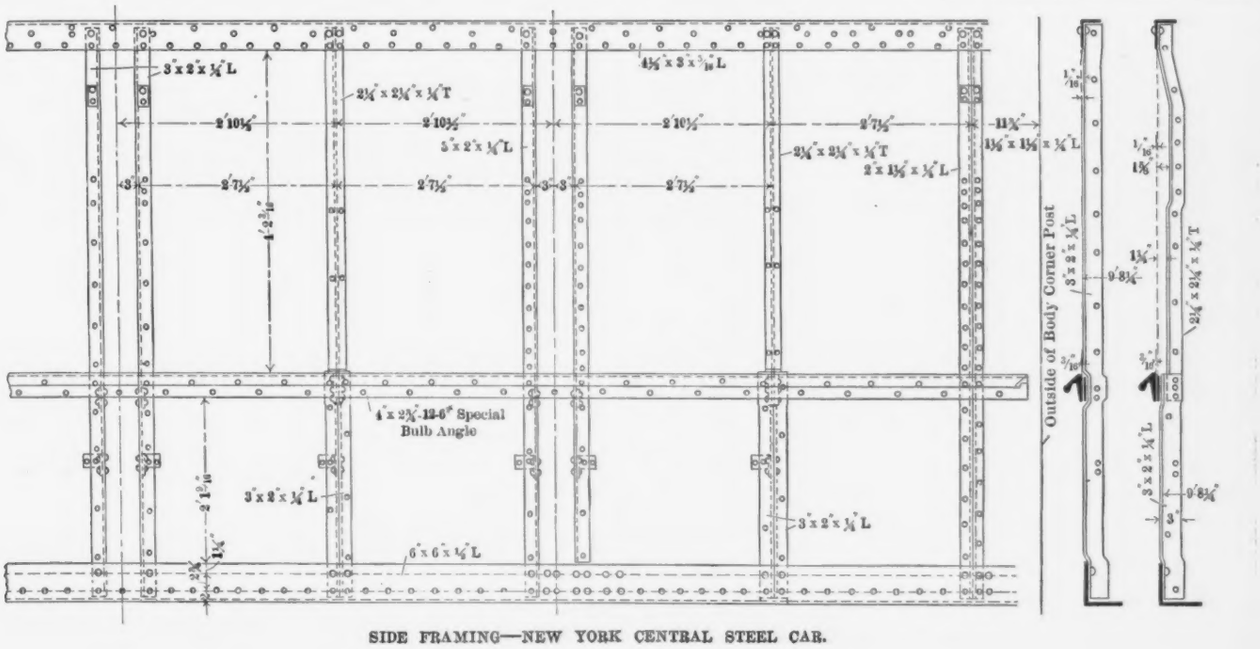
Steel passenger cars have been described and illustrated in this journal as follows: Illinois Central side-door suburban, Oct., 1903, pp. 358; New York Subway, all steel car, Oct., 1904, pp. 375; London Underground Ry., July, 1905, pp. 248; Southern Ry. (combination steel and wood), July, 1906, pp. 260; Long Island suburban car, Sept., 1906, pp. 340; Santa Fe postal car (steel underframe), Oct., 1906, pp. 397; Philadelphia Subway car, Nov., 1906, pp. 440; Harriman Lines steel coach, Jan., 1907, pp. 6; Long Island steel coach, Feb., 1907, pp. 40.







VIEWS OF FRAMING AND INTERIOR OF STEEL PASSENGER CAR—NEW YORK CENTRAL & HUDSON RIVER RAILROAD.



SIDE FRAMING—NEW YORK CENTRAL STEEL CAR.

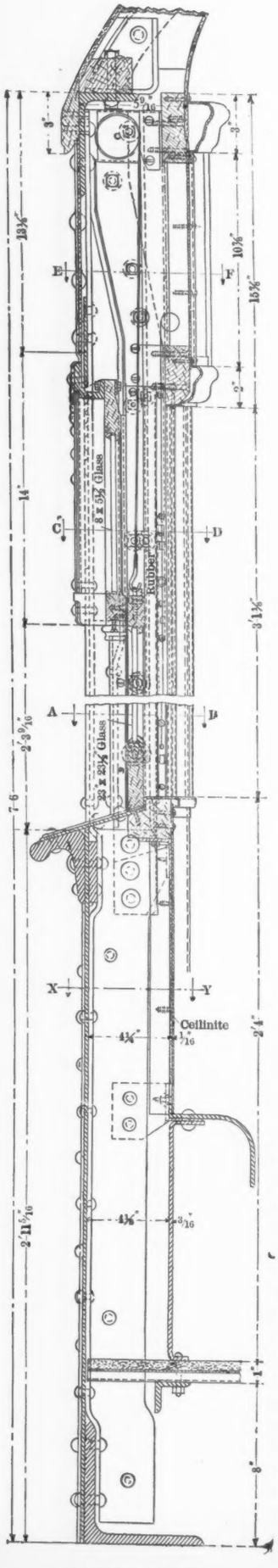
struction is the same as that of the Long Island steel coach designed and built by the same company, which was illustrated in the February issue of this journal, although it should be remembered that this is the earlier of the two designs. This scheme provides for the carrying of the whole load of the car body, including the underframe and the live load, by two plate girders, which form the sides of the car below the window sills. These are made up of a 3-16 in. web plate 36 ins. deep with a bottom or tension member consisting of a 6 x 6 in. angle which also acts as a side sill of the car. The top or compression member is in two parts, the outer one being a special 4 x 2¾ in. bulb angle and the inner a 7-16 x 3 in. bar. The girder is stiffened by the side posts of 3 x 2 in. angles, located in pairs about 34½ ins. apart and riveted to the web plate. These posts are off-set at the top and bottom of the girder to clear its upper and lower members. The web plate is made in three sections, the joint coming at the double 3 x 2 in. angles forming the cripple posts, where the plates are butt jointed and provided with a cover plate with sufficient rivets to make the joint of a strength equal to the solid plate.

The side posts consist in the case of the double piers of two 3 x 2 in. angles set 6 ins. apart extending from side sill to side plate and off-set as mentioned. In the case of the single posts which separate the two sashes of the double windows, they consist of the cripple posts of two angles set and riveted together and extending from the side sill to the belt rail, above which they are continued by a 2¼ x 2¼ in. T, carried to the side plate, the side plates being 4½ x 3 in. angles extending the full length of the car.

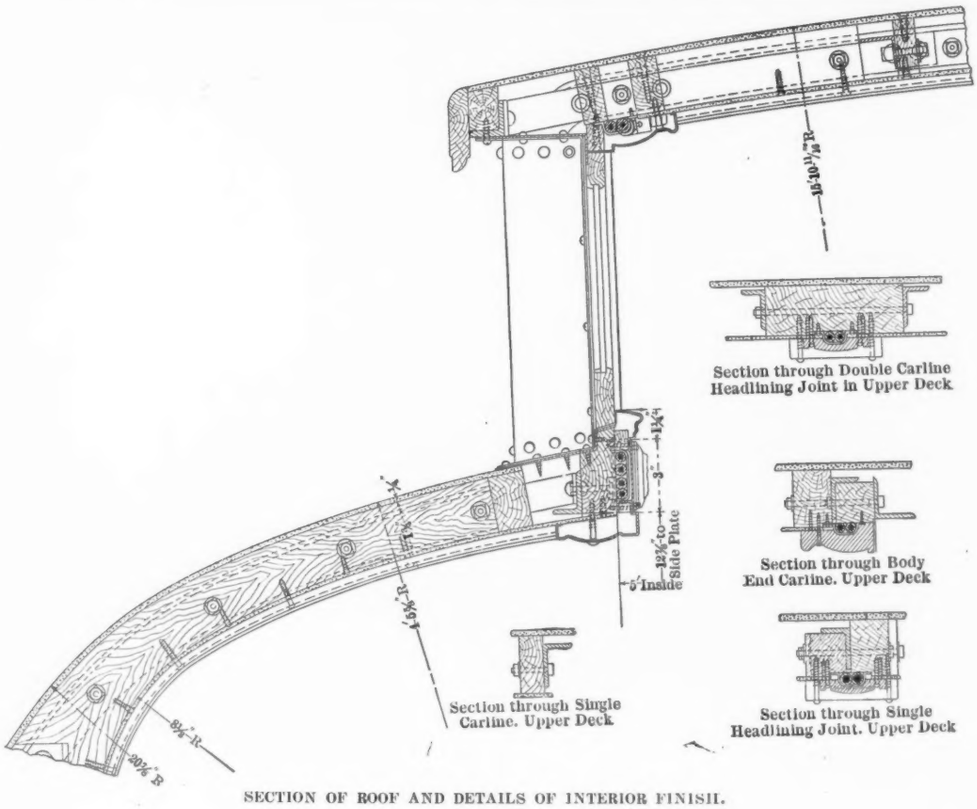
The carlines consist of 1¾ x 1¼ in. angles in one piece from side plate to side plate, being formed to the proper roof contour. There is a carline at the junction of each single side post, and two set 6 ins. apart at the junction of each double post, with the side plate. They are secured to the side plate by flanged corner angles. The carlines are spaced and stiffened by the purlines which consist of short sections of 1½ x 1½ in. angles set between the carlines and fastened by corner angles. The body end-carlines are double, being held together by rivets passing through spacing thimbles and the purlines and rafters not being continuous, this allows the removal of the vestibule roof in case of damage without disturbing the main parts of the body frame, the only continuous parts being the side plates and eaves angles. The vestibule roof construction includes two vertical ⅛ in. plates forming the sides of the clere story at this point, which being properly connected and stiffened, assist in carrying the weight of the platform and vestibule. The construction of the roof and vestibule is in its general features similar to that used on the Long Island car mentioned above, and reference can be made to the illustrations in that article for the basic features of this construction.

The underframe consists of two 8 in. 18 lb. I-beams set at 24 in. centres, continuous from buffer beam to buffer beam, which act as centre sills for taking the buffing and pulling strains. The weight of these, however, is transferred to the side girders by means of the cross bearers and they are not intended to support any of the weight of the car. They are turned out at an angle at either end for the purpose of giving clearance to the radial draft gear. The side sills are the 6 x 6 in. angles mentioned above as forming the lower part of the side girders. Auxiliary longitudinal or platform sills consisting of 8 in. channels extend from the junction of the centre sills and buffing beam back through the end sills and connect to the cast steel bolster. These platform sills, by means of the novel end sill construction and their special connection below the flange of the bolster are fulcrumed in the centre and prevent any sagging of the platform. The cross bearers, of which there are three between bolsters, consist of a trough-shaped pressed steel section passing below the centre sills and continuous between the side sills to which they are securely riveted. Special flanged filling pieces are set vertically at either edge of the trough section, extending between the side and centre sills; also similar pieces between the centre sills. A short cover plate passes through openings in the web of the centre sills and fastens to the top flanges of the filling pieces on either side. Since the filling pieces are also riveted to the sills and the flanges of the trough section the whole construction forms a box girder. The cover plate extends about 1-3 of the distance from the centre toward the side sills, which will allow it to be easily removed without disturbing the side sheathing. The underframing is further tied together and stiffened by two sets of diagonal ½ x 2½ in. bars connecting by gusset plates at the junction of the bolsters and cross bearers with the side sills. There are also diagonal members consisting of pressed steel channels between the ends of the bolsters and the junction of the end and centre sills. The end sills are made up of special flanged filling pieces set in pairs vertically between the centre and side sills and a malleable casting forming part of the draft gear arrangement between the centre sills. A channel which passes continuously below the centre and platform sills is turned up at either end between the flanged filling pieces and riveted to them.

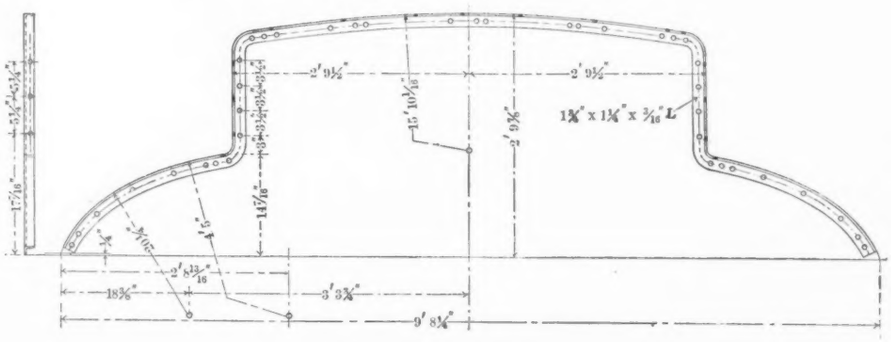
The bolsters are of cast steel of a special I-section design



SECTION OF SIDE.


Section through Double Carline Headlining Joint in Upper Deck
Section through Body End Carline. Upper Deck
Section through Single Carline. Upper Deck
Section through Single Headlining Joint. Upper Deck
Side Plate
5' Inside

SECTION OF ROOF AND DETAILS OF INTERIOR FINISH.

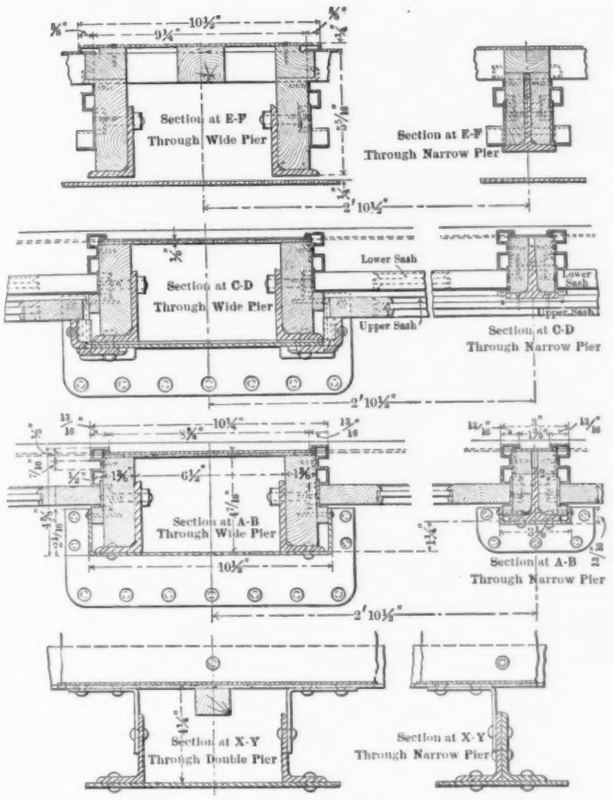


CARLINE—NEW YORK CENTRAL STEEL CAR.

with a broad top. They are arranged to fit around the centre sills and include the centre plate. Lugs are provided for the fastening of the platform sills. Cast steel filling pieces are fitted between the centre sills and above the flange of the side sills and a heavy cover plate passing through the webs of the centre sills and riveted to the outstanding flanges of the bolster is provided. This cover plate is also of such a length that it can be removed without disturbing the side sheathing. The bolster is so constructed that it can easily be removed without disturbing the structural part of the car. These bolsters carry practically the whole weight of the car body and its load from the side girders directly to the trucks.

The floor is of "Acandolith" laid on corrugated steel sheets, which are supported by the centre sills and longitudinal floor angles resting on the cross bearers and bolsters. These longitudinal angles are further supported by the floor beams extending from centre to side sills, equally spaced between the cross bearers. The floor is finished by a tread of narrow wooden strips which are screwed in place and give a secure footing. These run longitudinally in the centre aisle and cross-wise between the seats. As will be noticed in the section of the under frame, there is a clear space of about 4 ins. between the floor and the cross bearers, bolsters, etc., which permits the convenient installing of electric wires, air brake piping, etc.

The draft gear is of the National Malleable Casting Company's truck actuated radial design, which will permit the cars to be coupled positively and without difficulty on a 135 ft. radius curve. With this arrangement the spring draft gear is placed between the centre sills about 3 ft. ahead of the bolster and from it the draw-bar extends outward and downward, connecting to the coupler on a level below the centre sills. The draw-bar is pivoted just ahead of the draft gear and has a connection on either side to the corners of the truck frame; this connection has double ball joints and is fitted with springs and follower plates in such a manner that as the truck swings it will carry the draw-bar and coupler with it, always keeping the draw-bar exactly tangent to the curve.

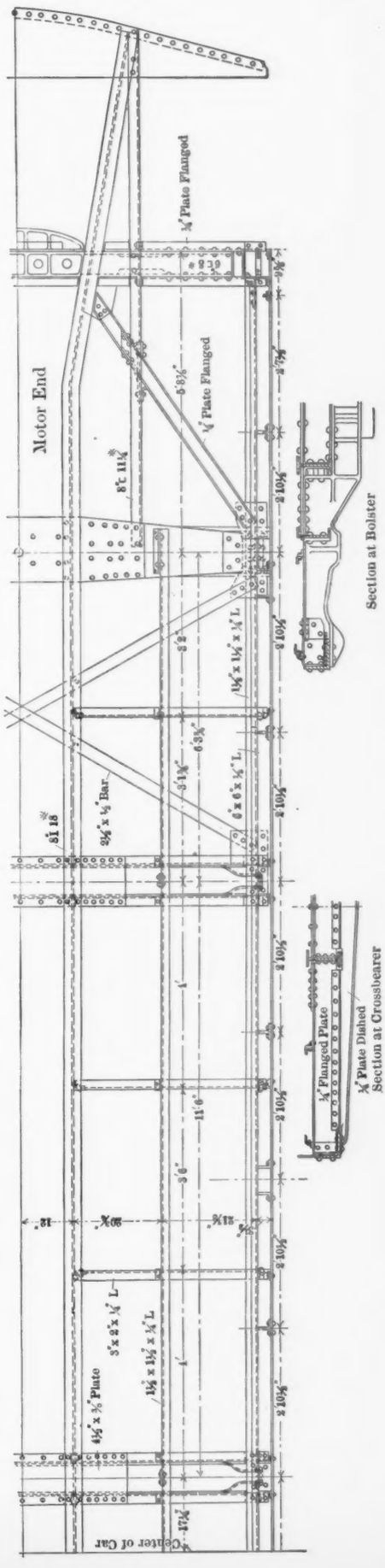

Section at E-F Through Wide Pier
Section at E-F Through Narrow Pier
Section at C-D Through Wide Pier
Lower Sash
Upper Sash
Section at C-D Through Narrow Pier
Section at A-B Through Wide Pier
Section at A-B Through Narrow Pier
Section at X-Y Through Double Pier
Section at X-Y Through Narrow Pier

SECTIONS OF SIDE POSTS.

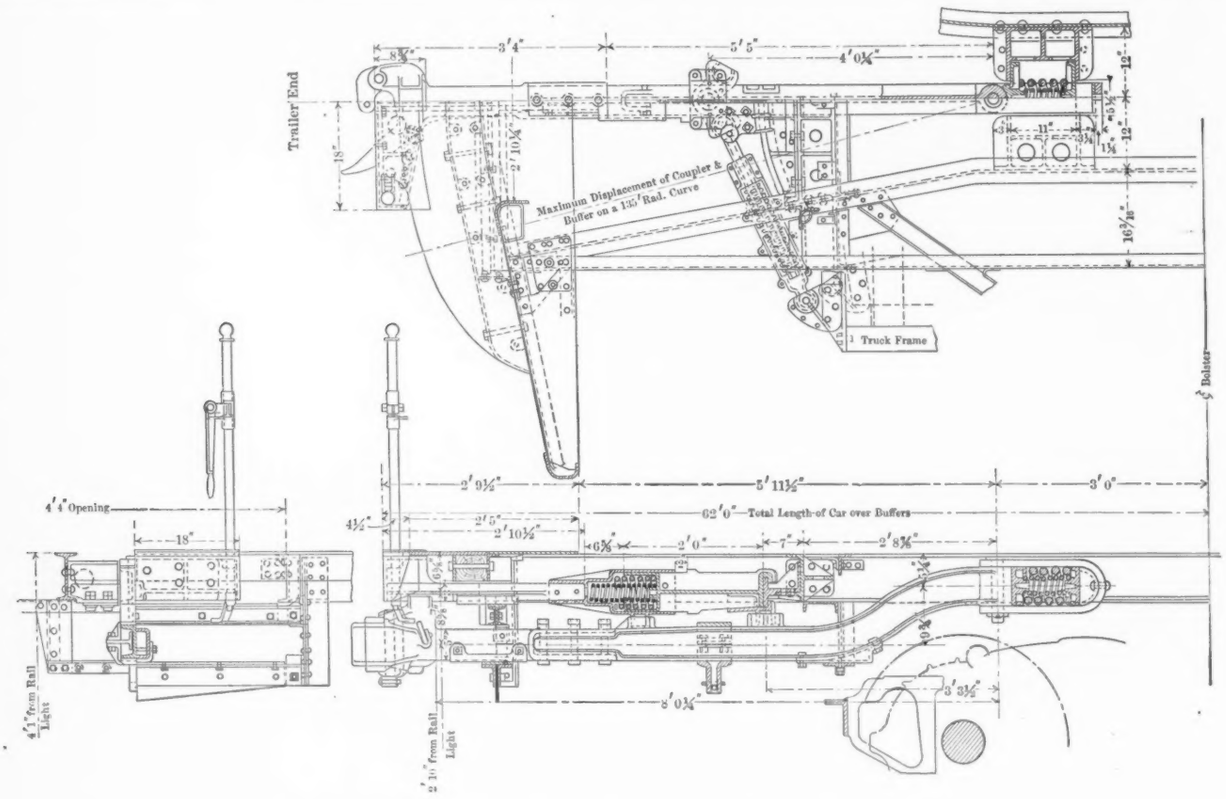
However, since the connection is made through springs any slight unusual movement of the coupler will not affect the truck. The air and steam hose are carried from the draw head and take the same movement. The spring buffer is also pivoted and connects to the draw-bar by a cast steel lug set in a pocket, so that it will take the same movement as the coupler and thus the buffing strains after passing the capacity of the spring buffer will be transferred to the draw-bar and thence to the centre sills. The whole arrangement is supported and secured to guides as shown in the detailed illustration.

The interior of the car is finished largely by drawn steel moldings and specially rolled steel plates. The head lining is of "Durite," which is a special artificial wood, as is also the outside of the roof, in the latter case being covered with painted canvas with copper flashings at the hips and eaves. The seats are of rattan, fireproofed, and fitted to steel frames, being of the "walk-over" type furnished by the Hale & Kilburn Company. The deck windows are of art glass and Automatic Ventilators to the number of four on either side of the clere-story and two in the saloons have been provided. The car is equipped for both electric and Pintsch gas lighting and has both electric and steam heating. The Pintsch gas chandeliers are located in the centre of the roof and the incandescent lights to the number of 30 along the edge of the deck in addition to 12 in pairs between the gas lamps. The electric heaters are placed beneath the seats and the steam heat pipes are placed along the side of the car in the usual manner. This double arrangement of heating and lighting is necessary since the cars will be operated over lines not yet electrified. An electric fan is placed just under the deck in each end of the car.

The motorman's control apparatus, which is located in the ends of the vestibules on the right side, consists of a Sprague General Electric master controller so arranged with a tripping device that if the motorman's hand leaves the handle the controller will spring to the off-position and at the same time give an emergency application of the brakes. This controller is situated for operation by the motorman's left hand and can be locked when not in use. Directly in front of the



UNDERFRAME—NEW YORK CENTRAL STEEL PASSENGER CAR.



TRUCK ACTUATED RADIAL DRAFT GEAR.—NEW YORK CENTRAL STEEL CAR.

motorman is the engineer's valve of the quick service Westinghouse brake system. He also has conveniently located a cord leading to an air whistle, and just behind him in the end bulkhead of the car is arranged a switchboard containing all of the switches and fuses necessary for operation from that end. This is closed and locked by a steel door. Each car is provided with an electric head light at either end located on the roof.

It will be noticed that there is an extension platform at the ends of the car outside of the vestibule which has been installed simply as a gangplank between the cars, made necessary by the large overhang of the radial coupler, which in turn is demanded by the sharp curves on which the car will be operated in the Grand Central station.

The car weighs 105,500 lbs. total, in running order. Of this the body of the car weighs 59,860 lbs. without electrical equipment and 67,200 lbs. with electrical equipment. The motor truck weighs 15,000 lbs. and the trailer truck 11,140 lbs., the weight of the motors alone being 12,160 lbs. for two, thus the car with one motor and one trailer truck but without motors or the electrical apparatus on the body would weigh 86,000 lbs. or about 1,344 lbs. per seated passenger, which compares very favorably with a modern substantially constructed wooden passenger coach.

The specialities in the car not previously mentioned are as follows: The Safety Car Heating & Lighting Co.'s Pintsch gas lighting, Gold Car Heating & Lighting Co.'s steam heat; Consolidated Railway Electric Light & Equipment Co.'s electric heaters. The hardware from Adams & Westlake Co. McCarthy continuous basket racks, Rostand Mfg. Co. The steel mouldings, Dahlstrom Metallic Door Co. The sash balances, National Lock Washer Co. Tower couplers, National Malleable Castings Co. Automatic ventilators, Automatic Ventilator Co. Safety treads, American-Mason Safety Tread Co. Door operating devices, Pitt Car Door Co. Curtains, Curtain Supply Co. The roof covering and head lining of "Durite," Indestructible Fibre Co. The "Celinite" for insulating the interior finishing, H. W. Johns-Manville Co. Signal lamps and brackets, Dressel Railway Lamp Works and thermometers, Parker Mfg. Co.

The general dimensions are as follows:

Length over buffers	60 ft. 0 ins.
Length inside body	48 ft. 11⅝ ins.
Width over side sills	9 ft. 8¼ ins.
Height, rail to top of roof	13 ft. 9½ ins.
Total weight in running order	105,500 lbs.
Weight of body	67,170 lbs.
Weight of body without electric equipment	59,860 lbs.
Weight of trucks—motor truck, 15,000 lbs., trailer truck	11,140 lbs.
Weight of motor and number per car	12,160 for two.
Weight of electrical apparatus without motors, included in body	7,340 lbs.
Seating capacity	64 passengers.
Number of saloons or toilet rooms	2.

Type of truck—Four-wheel motor truck, motor truck wheel base 7 ft. 0 in., 36-in. wheels; trailer truck wheel base 6 ft. 0 ins. and 33-in. wheels.

THE STORE AND SUPPLY DEPARTMENT.—If you will investigate fully you will find that the material issues of a railroad cover more than 45 per cent. of the entire operating expenses. As every one present knows, the subject of handling, storing and distributing this material is receiving more general attention by the executive officials than ever before. For the double reason of its magnitude and the nature of the operations in this department there lies an opportunity as in few others of a railway for causing disastrous waste, or effecting immediate and far reaching economies. Through poor management, carelessness, faulty judgment in our department there may be waste:

In money tied up.

In selection of poor material.

In lack of care, permitting shrinkage, etc., while in stock.

Through not ordering promptly, or just in advance of the need.

Through imperfect handling and delayed delivering.

In office work through inadequate system.

Unless these evils are prevented, or remedied, if they already exist, the work of the store and supply department will fall far short of the maximum efficiency.—*Mr. N. M. Rice, before the Railway Storekeepers' Association.*

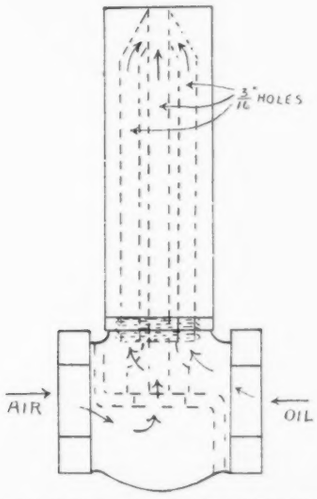
The total number of boiler explosions in 1906, as recorded by the Hartford Steam Boiler Inspection & Insurance Co., was 431 or 19 less than for 1905.

WELDING FRAMES WITH OIL.

BY C. J. MORRISON.

Broken frames have always been an item of considerable expense, and with the modern heavy engines this expense has assumed serious proportions. Not only, under ordinary circumstances, does the repair of a broken frame require almost complete stripping of an engine, but it keeps it out of service from five to ten days, depending upon the shop facilities. A number of methods of welding the break without removing the frame from the engine have been tried. Probably the cheapest and best of these is that of heating the frames to the welding point by means of an oil torch. The details of making the weld differ in different shops, but the general method is the same.

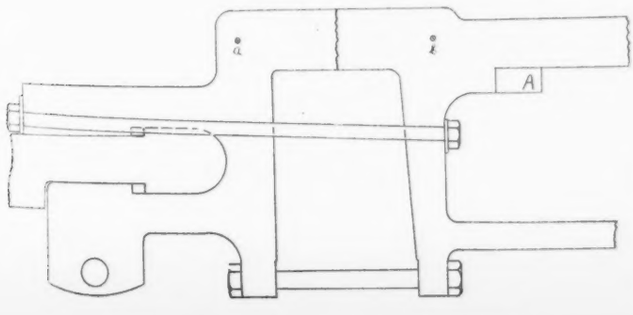
Crude oil is used and there are many designs of burners. One of the most successful is shown in the accompanying



OIL BURNER FOR WELDING FRAMES.

sketch. With this burner a 4 x 4 in. section can be brought to a welding heat in from forty-five to fifty minutes. The burner is a half inch globe valve with an atomizing attachment screwed in the top in place of the valve. Oil enters at one side of the valve and air at the other. The oil passes through the outside passages of the burner and the air through the centre one. The oil is fed by gravity from a tank holding about twenty gallons, which may be stood on the running board or any other convenient place. Air is used from the shop line and will give good results at pressures from 75 to 100 lbs. per sq. in. The oil and air pipes must have the valves about four feet from the burner so that the operator can handle them without being blistered by the heat. One burner will do for sections up to about 4½ x 4½ ins., but for sections larger than this it is advisable to use two burners, one on each side of the frame.

Different designs of frames and breaks in different sections will require a variation in the method of welding, but a description of the method used in welding a break over the front driving box on a heavy 2-6-2 type engine will probably make



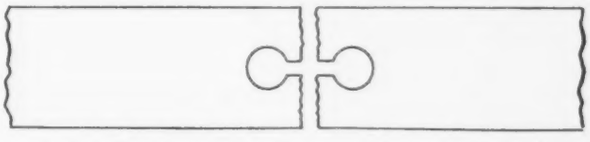
METHOD OF CLAMPING FRAME FOR WELDING.

the general method clear. The section at the break was 6 x 7 ins., or 42 sq. ins. The frame was held rigidly in place and with a tram, with arms about 18 ins. long to clear the furnace, punch marks *a-b* were made. A tram was also set to show the distance the jaws should be apart at the bottom. A jack was then placed in the jaws and the break was opened up. The bad iron (about ¼ in.) was chipped out with an air hammer. A piece of iron of slightly tapering section, ¾ of an inch thick at the centre, and measuring 6¼ x 7¼ ins. outside, was placed in the break. Heavy bolts were then placed across the jaws, as shown. The jack was slacked off and the bolts tightened up until the piece was held securely in place. A piece of iron ('A') 3 ins. wider than the frame was then bolted on the frame.

A furnace of fire brick and clay supported on a sheet of iron on horses was next built up around the break. The inside dimensions of the furnace at the break were 8 ins. long by 16 ins. high, so placed that the bottom of the furnace was 6 ins. below the frame and the sides 4 ins. each side of the break. The furnace tapered off from this size, at an angle of about 30 degs. with the frame, to two openings about 3 x 3 ins., one each side of the frame, level with the bottom of the furnace and 18 ins. from the frame. Just above the break a vent of similar size was left.

In building the furnace half bricks were placed, at a number of places, so that they could easily be removed, thus leaving openings through which the weld could be worked. Both burners were started and the frame heated up to the welding point. Borax was used freely as a flux. Several heavy blows were then struck at "A" with a ram and the bolts were drawn up until the tram showed the frame to be within 3/16 in. of its normal length. One burner at a time was then shut off and the weld was worked up with a heavy long stroke air hammer, using a bar three feet long placed through one and then another of the holes left for this purpose. Both burners were then extinguished, the furnace quickly knocked down and the weld trimmed up.

Another method that has proved successful where the section of the frame to be repaired is subject to severe up and down stresses was to drill two 2-in. holes, 4 ins. apart, one each side of the break and then on the centre line between the holes to drill ¾-in. holes. The frame was then spread until the centres of the 2-in. holes were 5 ins. apart. The bad iron in the break and the iron between the holes was chipped out with an air hammer, as shown in the sketch. A piece was then



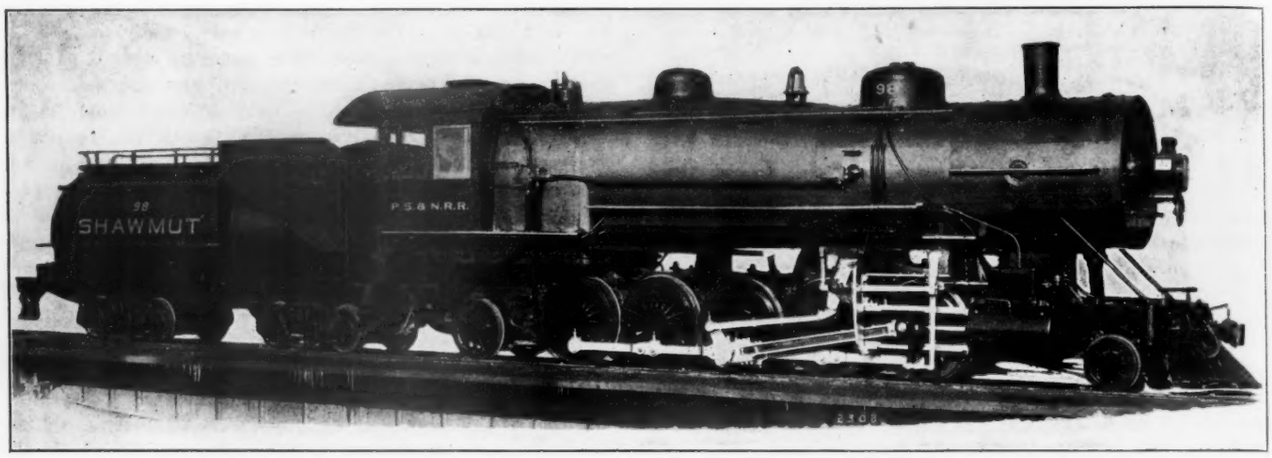
forged and machined to fit this opening and was driven in. Pieces were also put in the break on each side of the connecting piece and the weld was made as above.

One prominent shop shows the following cost of welding frames with oil:

Erecting shop	$16.41
Rod Work	6.09
Forge	16.44
Miscellaneous	3.78
Total	$42.72

This total cost is only a few dollars more than the actual cost of welding alone when the frame is taken down and sent to the forge.

PLANER VS. MILLING MACHINE.—To sum up, then, my belief is that where the simpler plane surfaces that naturally lend themselves to grouping are to be produced, the planer with a proper equipment is the natural machine to use, and will be found to give the lowest piece cost. It is understood, of course, that the piece cost when figured includes its proportionate share of fixed costs as it always should.—*Mr. H. P. Fairfield, in Machinery.*



SIMPLE FREIGHT LOCOMOTIVE WITH BALDWIN SUPERHEATER—P. S. & N. R. R.

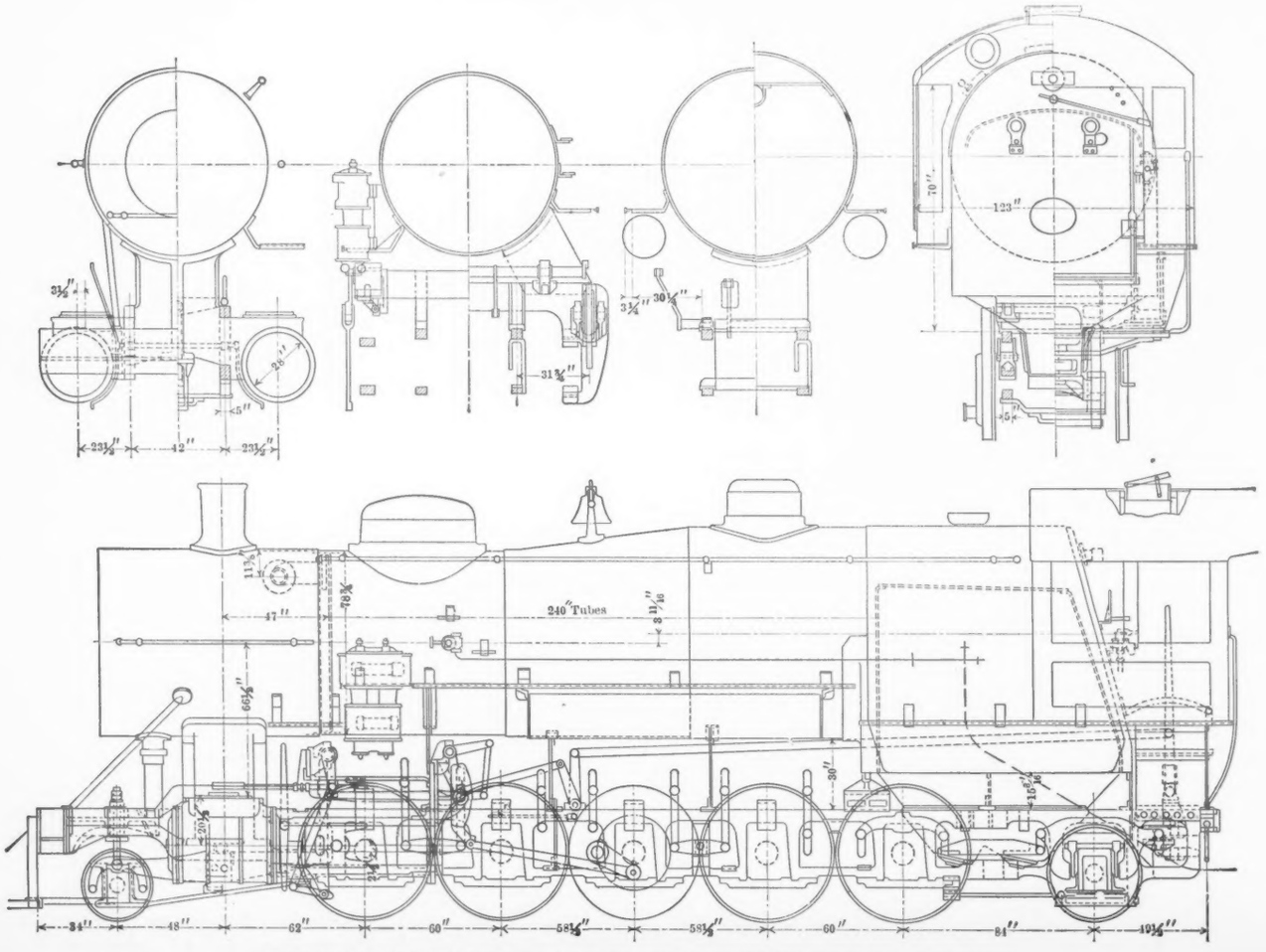
SANTA FE TYPE LOCOMOTIVE WITH SMOKEBOX SUPERHEATER.

PITTSBURG, SHAWMUT & NORTHERN RAILROAD.

The Baldwin Locomotive Works recently completed a very heavy simple 2-10-2 type locomotive, for the Pittsburg, Shawmut & Northern Railroad, which is illustrated herewith.

This locomotive is distinctive for a number of reasons. In the first place it is the thirtieth thousandth locomotive turned out from the Baldwin Locomotive Works; it is the heaviest simple locomotive ever built; it has the largest simple cylinders ever applied to a locomotive; it is equipped with a smokebox superheater of new design and it carries but 160 lbs. steam pressure. The locomotive in general size and appearance is very similar to the tandem compound locomotives, of which there are a large number in operation on the Atchison, Topeka & Santa Fe Railway. These were illustrated in this journal in 1903, pages 372 and 398; 1904, page 176. It exceeds those locomotives in total weight, but does not have quite as large a tractive effort.

The simple cylinders are equipped with slide valves, operated by the Walschaert valve gear. This arrangement of the valve gear has the combination lever on the outside of the guides, and in order to prevent the valve chest from exceeding the clearance limits the valve has been thrown 3½ ins. inside the center line of the cylinders and the connection to the gear is made through a rocker arm having both arms pointed downward and supported in bearings bolted to the cross tie, which in turn is supported on lugs cast in one piece

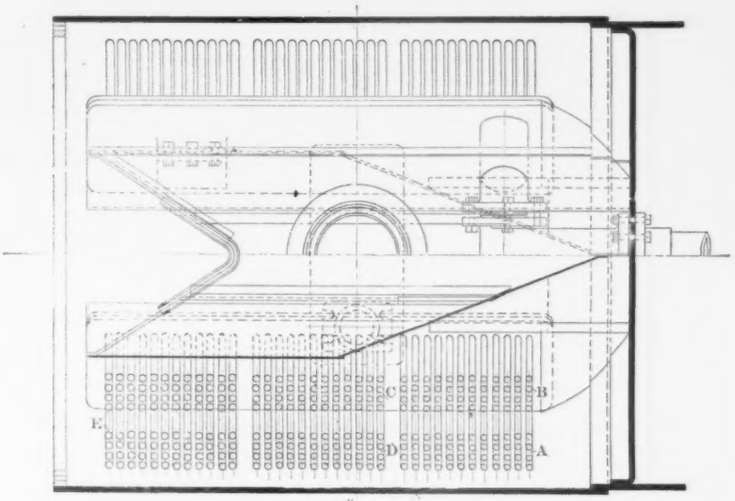


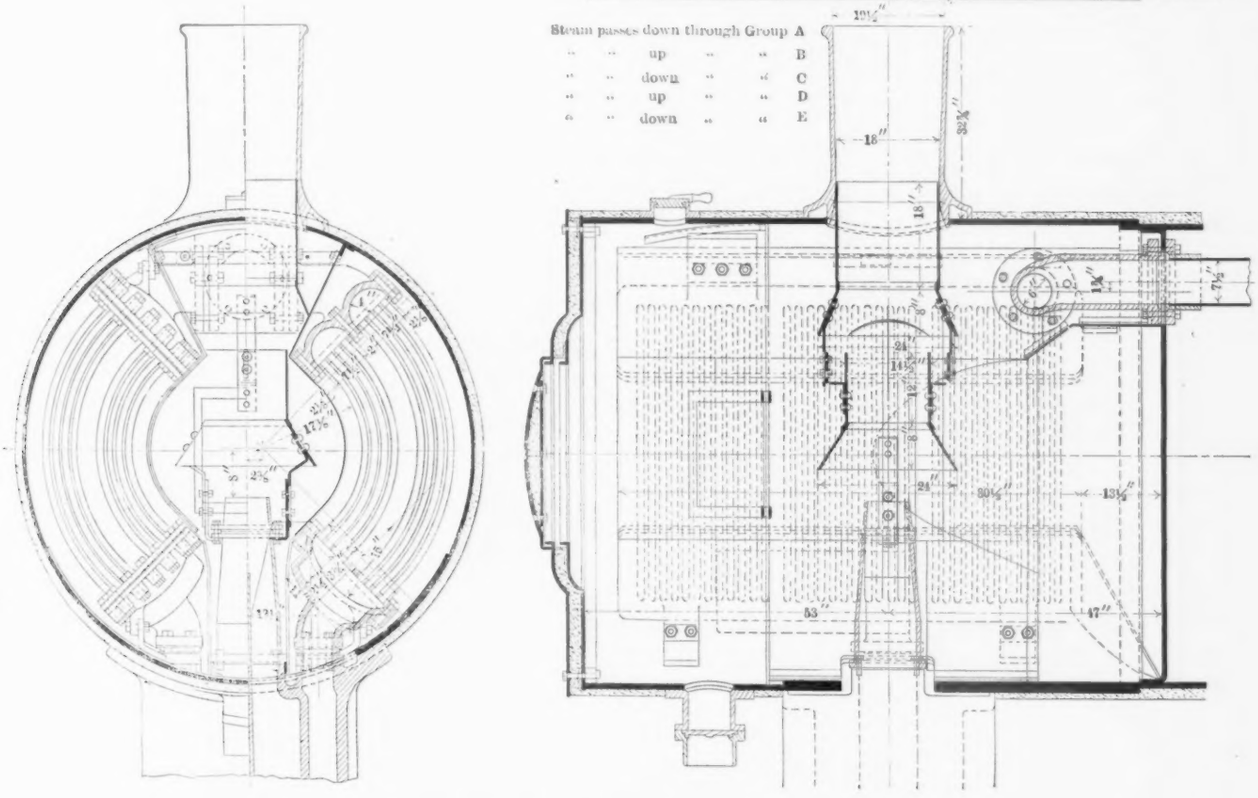
ELEVATIONS AND SECTIONS—SIMPLE FREIGHT LOCOMOTIVE WITH SUPERHEATER.

with the upper frame rail. The outer arm of the rocker shaft is connected to the combination lever and the inner one to the valve stem through a cross head connection.

The boiler is of the extended wagon top type, being 78¾ ins. in diameter at the front ring and 86 3/16 ins. at the dome course. The tubes are 20 ft. long and 2¼ ins. in diameter, there being 391 in the barrel. The cylinders, which are 28 ins. in diameter, with a 32-in. stroke, are the largest ever applied to a simple locomotive, and are equivalent to a 25 x 32-in. cylinder with 200 lbs. steam pressure. Each cylinder is cast with half of the saddle in the usual manner.

The point of greatest interest in this locomotive is the superheater which has been applied in the front end. Reference to the illustrations will show the design and arrangement of this device, and it will be readily noticed that this type of superheater does not interfere with the ordinary boiler, simply requiring an extended smokebox. It can be fitted to any locomotive now using saturated steam by the application of a new smokebox, and it can also be removed from any locomotive without interfering with its operation with saturated steam by simply replacing the superheater with the ordinary steam pipes. In brief, the superheater consists of two cast steel headers on either side, which are cored with the proper passages and walls. These headers are connected by a large number of curving tubes, which follow the contour of the smokebox shell. The tubes are expanded in tube plates, and these plates are bolted to the headers. The curving tubes are divided into groups and the passages in the headers are so arranged that the steam after leaving the T head on either side passes down through the group forming the outer four rows of the rear section of superheater tubes, then crosses over in the lower header and passes up through the inner four rows of the same section, thence down through the inner group of the next section and up through the outer group, and thence down through both the inner and outer groups of the forward section and through a passage way in the lower header to the saddle. These tubes are heated by the gases from the fire tubes and the deflecting plates are so arranged as to compel these gases to circulate around the tubes on both sides to the front end of the smoke box and thence back through the center to the stack. Thus the superheater uses only such heat as is ordinarily wasted through the stack, and whatever gain in superheat is obtained is clear gain. Experiments so far made with this type of superheater show that while it is not possible to obtain a very high degree of superheat, enough is obtained to very decidedly increase the economy of the boiler. The front end is heavily lagged at all points to prevent, as far as possible, all loss of heat by radiation. The arrangement of the draft pipes, stack and exhaust nozzle is clearly shown in the illustration.





BALDWIN SUPERHEATER—P. S. & N. R. R. LOCOMOTIVE.

The general dimensions, weights and ratios of the locomotive are as follows:

GENERAL DATA.

Gauge	4 ft. 8½ in.
Service	freight

Fuel	bituminous coal
Tractive effort	60,000 lbs.
Weight in working order, est.	288,000 lbs.
Weight on drivers, est.	235,000 lbs.
Weight of engine and tender in working order, est.	450,000 lbs.
Wheel base, driving	19 ft. 9 in.
Wheel base, total	35 ft. 11 in.
Wheel base, engine and tender	67 ft. 4½ in.

RATIOS.

Weight on drivers ÷ tractive effort	3.92
Total weight ÷ tractive effort	4.8
Tractive effort x diam. drivers ÷ heating surface	715
Total heating surface ÷ grate area	82
Firebox heating surface ÷ total heating surface, per cent	4.4
Total heating surface ÷ superheater heating surface	6.3
Tube heating surface ÷ superheater heating surface	6.
Weight on drivers ÷ total heating surface	49
Total weight ÷ total heating surface	60.3
Volume both cylinders	22.82 cu. ft.
Total heating surface ÷ vol. cylinders	210
Superheater heating surface ÷ vol. cylinders	33.4
Grate area ÷ vol. cylinders	2.57

CYLINDERS.

Kind	Simple
Diameter and stroke	28x32 in.
Kind of valves	Bal. slide

WHEELS.

Driving, diameter over tires	57 in.
Driving, thickness of tires	3½ in.
Driving journals, main, diameter and length	11x12 in.
Driving journals, others, diameter and length	10x12 in.
Engine truck wheels, diameter	29¼ in.
Engine truck, journals	6½x10½ in.
Trailing truck wheels, diameter	40 in.
Trailing truck, journals	7½x12 in.

BOILER.

Style	E. W. T.
Working pressure	160 lbs.
Outside diameter of first ring	78¾ in.
Firebox, length and width	108x78 in.
Firebox plates, thickness	⅜ & 9-16 in.
Firebox, water space	F-4½, S-5, B-4 in.
Tubes, number and outside diameter	391-2¼ in.
Tubes, length	20 ft.
Heating surface, tubes	4,586 sq. ft.
Heating surface, firebox	210 sq. ft.
Heating surface, total	4,796 sq. ft.
Superheater heating surface tubes	704 sq. ft.
Superheater heating surface, drums	58 sq. ft.
Superheater heating surface, total	762 sq. ft.
Grate area	58.5 sq. ft.
Smokestack, diameter	18 in.
Center of boiler above rail	118 in.

TENDER.

Tank	Vanderbilt
Frame	Steel
Wheels, diameter	33 in.
Journals, diameter and length	5½x10 in.
Water capacity	8,500 gals.
Coal capacity	14 tons.

INSTRUCTIONS TO GOVERN THE USE OF COKE ON LOCOMOTIVES.

Mr. J. E. Muhlfeld, general superintendent of motive power of the Baltimore & Ohio Railroad, has issued the following instructions to govern the use of coke on the locomotives on that road. This is a subject that is of much importance as a possible solution of the smoke problem, particularly on those roads having freight terminals within the limits of large cities, and we are pleased to be able to publish these instructions at this time.

Coke should be of a hard quality, as free from dust as practicable, and of 48 or 72 hours' burning.

When coke is furnished from chutes to locomotive tenders the floor of the chute should be arranged as a screen so that the fine dust will be removed and not passed to the tender. The screen should be made of 1-in. round steel bars, spaced 1 in., and running longitudinally.

When coke is handled from a car into buckets from which it is to be supplied to the tender, ballast forks should be used for handling the coke when filling the buckets.

After the tender has been furnished with a supply of coke it should be thoroughly wet down to further eliminate the fine dust and carry it to the bottom of the tender, from which point it should be removed from time to time.

As a sharper blast is required for a coke fire, locomotives using coke as fuel should be equipped with exhaust nozzle openings about ¼ in. smaller in diameter than those for bituminous coal-burning locomotives.

Coke-burning locomotives should be equipped with finger style of rocking grates, in order to crush the clinker and to give better draft than can be secured with the bar types of rocking grates. The grate area should be as large as practicable and the rocking, dead and drop grates and operating gear should be kept in good adjustment to permit of free operation and without lost motion. As coke contains a much greater percentage of fixed carbon and ash than bituminous coal, it is very essential that the grate gear be maintained as above specified to insure against any difficulty of removing the ash and incombustible matter from the firebox.

Locomotives with large diameter and short flues will give the best results on account of remaining unobstructed and giving freer draft than smaller and longer flues.

Brick arches should not be used in fireboxes of coke-burning locomotives, as they interfere with maintaining the proper depth of fire. With coke a much heavier fire is required than with bituminous coal, as it does not pack so closely and there is liability for the introduction of cold air through the grates, which will lower the temperature of the gases and cause failures to steam.

The preparation of the coke fire must be given careful attention. Wood and semi-bituminous, low volatile soft coal should first be applied to the grates. This will assist in igniting the coke and preventing it from clinkering over the grate surface. After the coal has been thoroughly ignited the coke should be introduced until the firebox has been filled. The steam blower must be used until the coke is well burned through and makes a solid body of fire. The fire should then be left in this condition until the locomotive has commenced work and until 15 or 20 miles have been run; then at the first opportunity, preferably when steam is not being worked, the firebox should be filled with a fresh supply.

The fires should be cleaned after each 24 hours of service, and at the same time the flues should be blown out with the air blower equipment, that should be installed at each of the fire cleaning stations.

Engineers will be responsible for the proper operation of locomotives with respect to the handling of the reverse and throttle levers and to the supplying of feed water.

Engineers and firemen will be equally responsible for the operation of steam blowers and for the economical firing of locomotives, in accordance with the following general instructions:

Before the commencement of a trip or day's work the rocking and drop grates, ash pan dampers, ash pan slides and grate and ash pan operating gear should be examined and tested to see if all grates set level when latched, and that all parts are in good working order and proper position. The smokebox and ash pan should be clean and the smokestack and ash pan steam blowers in good order. All necessary fire tools, including a slash bar to prevent formation of clinker on grate surface, and scraper to remove the honeycomb that accumulates on the flue heads, must be on the locomotive. The fire must be put in good condition on the grates preparatory to starting, with a full supply of water and steam in the boiler. The coke on the tender should be wet down.

As heavy a fire should be kept on the grates as is necessary to prevent loss of heat, on account of cold air passing through the grates so freely as to reduce the temperature of the gases and to suit the way the locomotive is being operated. Fresh coke should be supplied to the firebox when the throttle is shut off. The use of the rake and puddling of the fire should be resorted to only when absolutely necessary to spread an uneven fire caused by uneven draft or improper firing.

The smokestack blower should not be operated any more than necessary, on account of coke burning out more quickly than coal, and when the ash commences to accumulate the blower will tend to draw cold air and ash into the flues instead of heat.

Rocking grates must be shaken lightly and frequently instead of violently at long intermittent periods, and, if possible, when steam is shut off. As a general rule, all rocking grates on passenger locomotives should be shaken every 20 miles; on freight locomotives every 10 miles, and on switching locomotives every hour. This practice will break any clinker that may be forming over or hardening between the

grate openings, and will allow dead ashes to fall into the ash pans and keep the grates and fire clean. It will also allow air to pass through the grates and fire and prevent the formation of clinker on the firebox flue and crown sheets, which occurs when air cannot get through the grates and must pass over the fire.

The practice of opening the furnace door unnecessarily should be avoided, and firemen must regulate the ash pan damper openings to suit all requirements. When locomotives are drifting the fires must be maintained in a clean and bright condition over the entire grate area, more especially at the flue sheet.

Hopper slides of ash pans must not be opened when the locomotive is running. Ash pans and fires should not be cleaned near any frog, switch, crossing, de-rail or wooden building or structure.

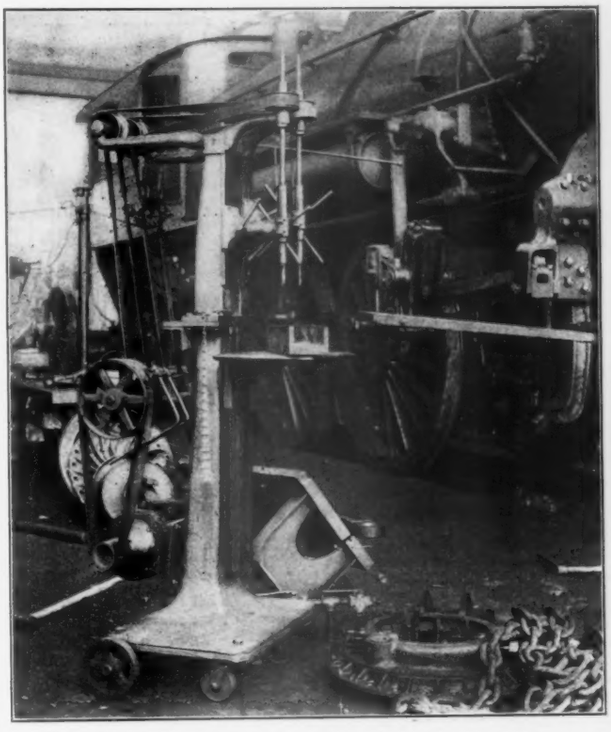
The above methods are those of the most successful firemen, and the highest type of fireman is one who can maintain the working steam pressure within a range of 10 lbs. variation with the smallest amount of fuel and the least waste of steam through the pop valves.

PORTABLE MACHINE TOOLS IN THE ERECTING SHOP.

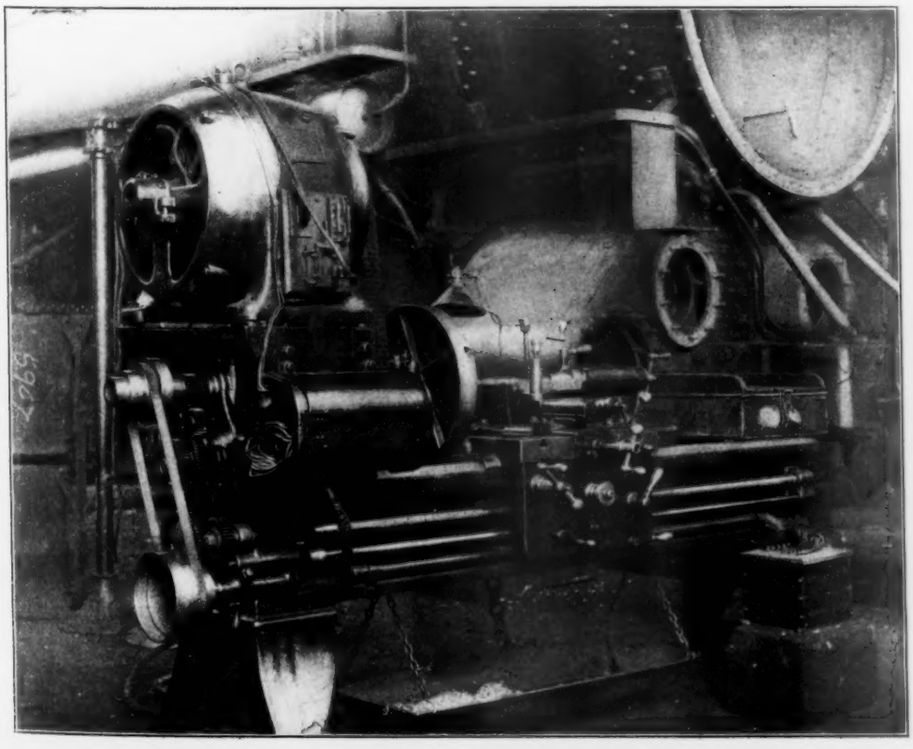
The two portable tools, illustrated herewith, are being used to very great advantage in the erecting shop of the Lake Shore & Michigan Southern Railway at Collinwood. Both of these tools are motor driven and receive current through flexible cords from stands or lamp-posts between the pits. These lamp-posts are arranged to take extension-cord plugs for portable incandescent lamps and also have a 25 ampere capacity extension plug receptacle from which flexible cords may be carried to any point to operate 5 h. p. motors. One of these lamp-posts is shown to the left of the lathe.

The two-spindle sensitive drill is mounted on rollers and can readily be transported over short distances on these, although for longer distances it is usually carried by the traveling crane. This drill is used almost entirely by the shoe and wedge machinists and effects a considerable time saving in this work.

The 18-in. lathe is used principally for turning cylinder, saddle and frame bolts. It is transported to different points on the erecting floor by the traveling crane. In lifting the lathe a hook is passed through the eye-bolt at the top of the motor and a chain is passed around the bed at the tail-stock end. The cast iron pan, suspended underneath the bed by chains, catches the greater part of the cuttings so as not to litter the floor. The electric light attached to the standard on the lathe carriage receives its current from the lamp-post. The lathe can quickly and easily be placed near an engine when the bolts are ready for fitting and the operator does not have to waste his time running back and forth between the machine and erecting shop.

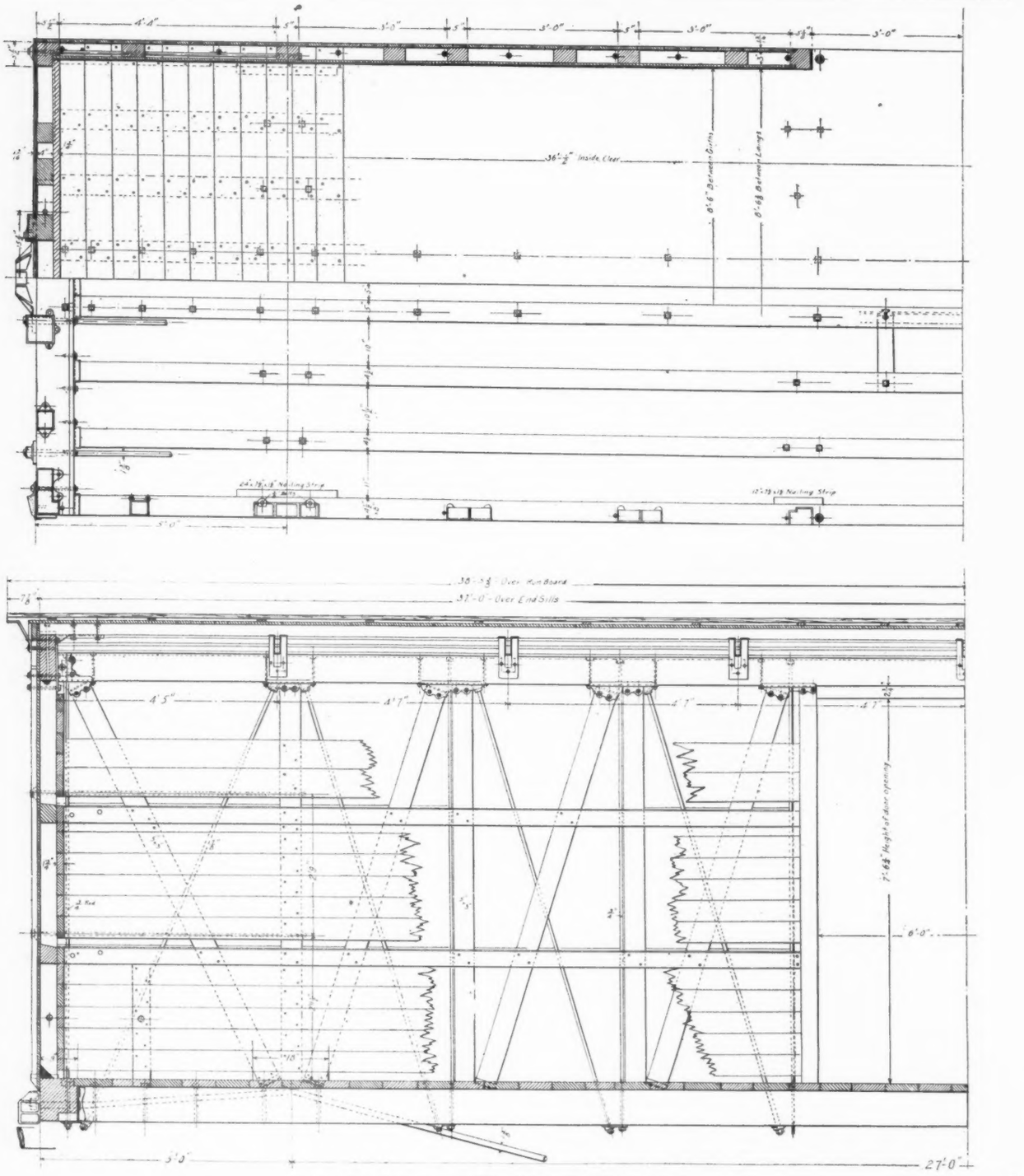


PORTABLE TWO SPINDLE DRILL IN ERECTING SHOP.



18-INCH LATHE IN ERECTING SHOP.

FUNCTION OF THE TOOL ROOM.—In a broad sense it has been said that the prime function of the tool room is to act in the capacity of an arsenal to provide the management with the necessary weapons to wage war upon excessive cost; the word "excessive" is here used to indicate any excess of cost beyond that minimum at which it is possible to produce the article to be manufactured. Now and then a master mechanic tells us he has built and repaired engines without having any tool room connected with the shop. In days gone by, successful battles were fought with clubs, bows and arrows; but what chances would these same armies stand with a modern army equipped with modern weapons? An aim of every superintendent of motive power is to obtain the most extensive output possible at the lowest cost, and the tool room is perhaps the most important factor in bringing about such a result.—*Mr. H. W. Jacobs in the Engineering Magazine.*



STANDARD BOX CAR—NEW YORK CENTRAL LINES.

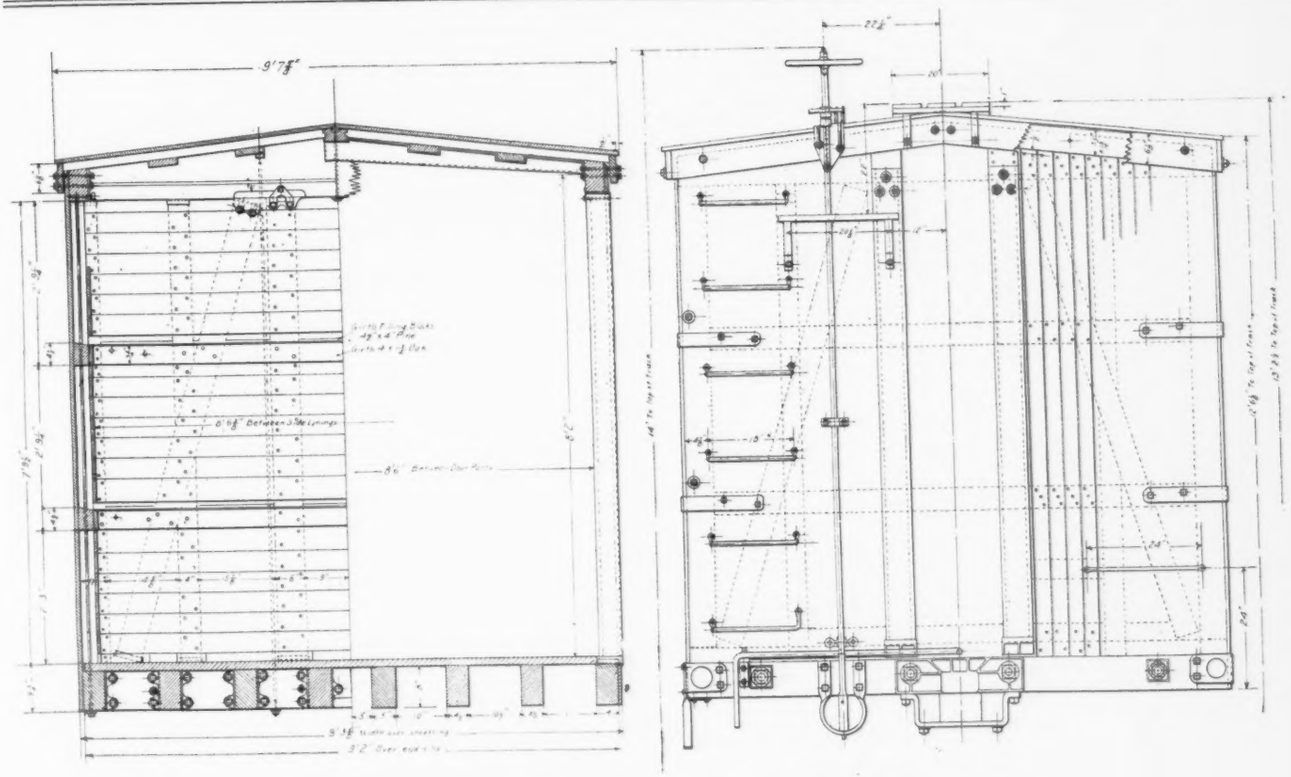
STANDARD 40-TON BOX CAR.

New York Central Lines.

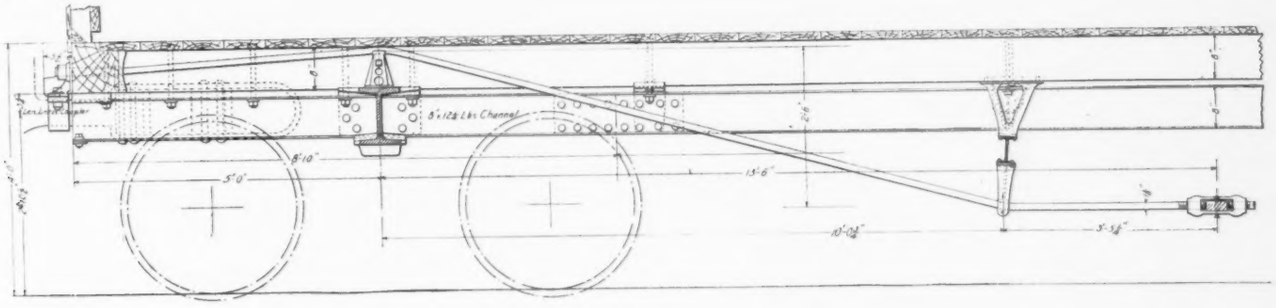
About two years ago the officials of the mechanical department of the New York Central Lines appointed a committee to prepare designs for a standard 36 ft., 80,000 lb. capacity, box car. When the designs were completed four cars were partially constructed at each of four points on the system in order to show clearly the different details of construction. These were then carefully examined and criticized by the various officials and the design was perfected. The system has recently ordered 6,000 of these cars, the general dimensions of which are as follows:

Length over end sills	37 ft.
Length over couplers	40 ft. 2 ins.
Length inside of lining	36 ft. ½ in.
Width over sills	9 ft. 2 ins.
Width over eaves	9 ft. 7⅝ ins.
Width inside of girth	8 ft. 6 ins.
Width between lining	8 ft. 6⅜ ins.
Width, extreme, over door handles	10 ft.
Width of door openings	6 ft.
Height of door opening	7 ft. 6¾ ins.
Height, top of rail to eaves	12 ft. 6⅞ ins.
Height, top of rail to top of brake mast	14 ft.
Height, top of rail to top of running board	13 ft. 2½ ins.
Height, top of rail to centre of draw bar	2 ft. 10½ ins.
Height, top of floor to bottom of carline	8 ft. 2 ins.
Truck wheel base	5 ft. 6 ins.
Total wheel base	32 ft. 6 ins.
Approximate light weight	39,000 lbs.

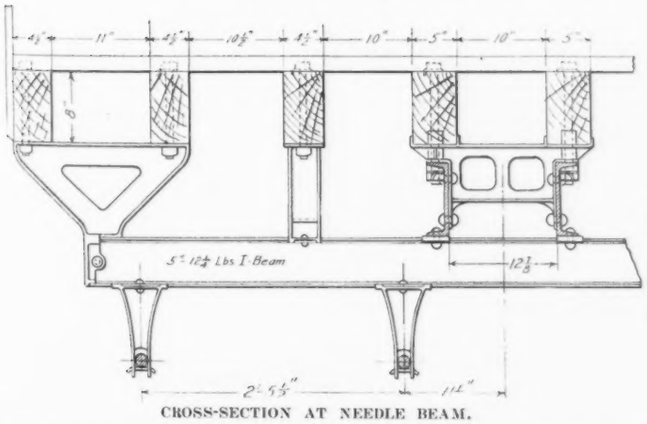
The underframe consists of two 5 x 8 in. centre sills, four 4½ x 8 in. intermediate sills and two 4½ x 8 in. side sills. These longitudinal sills are not mortised to the end sills, as is the usual practice, but their ends fit into malleable iron pocket castings, which are fastened to the end sills by lag screws, except in the case of the side sill pockets, which are secured by the same two bolts as the push pole casting. A combination pocket casting is used for the two centre



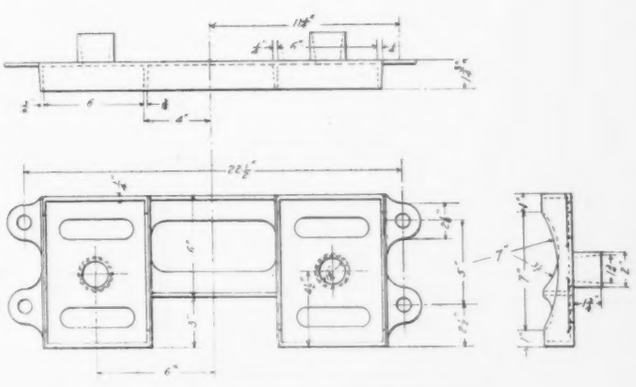
SECTIONS AND END VIEW OF STANDARD BOX CAR—NEW YORK CENTRAL LINES.



DRAFT BEAMS AND TRUSSING.



CROSS-SECTION AT NEEDLE BEAM.

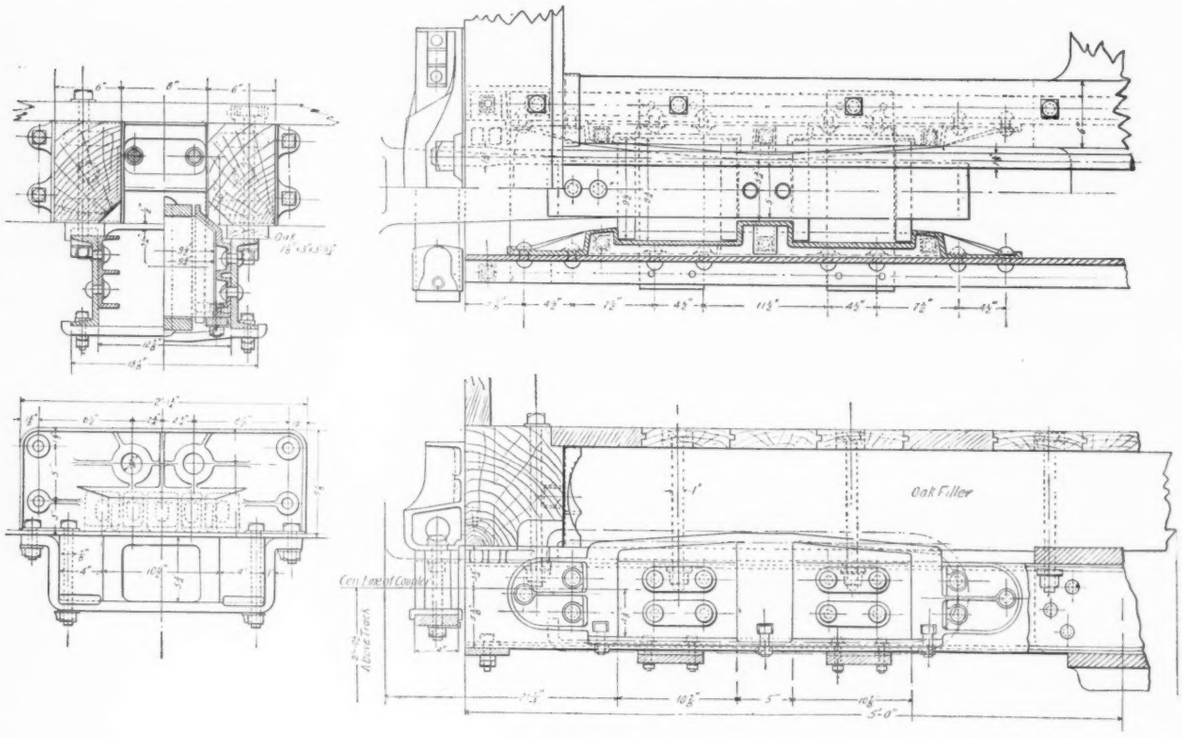


POCKET CASTING FOR CENTER SILLS.

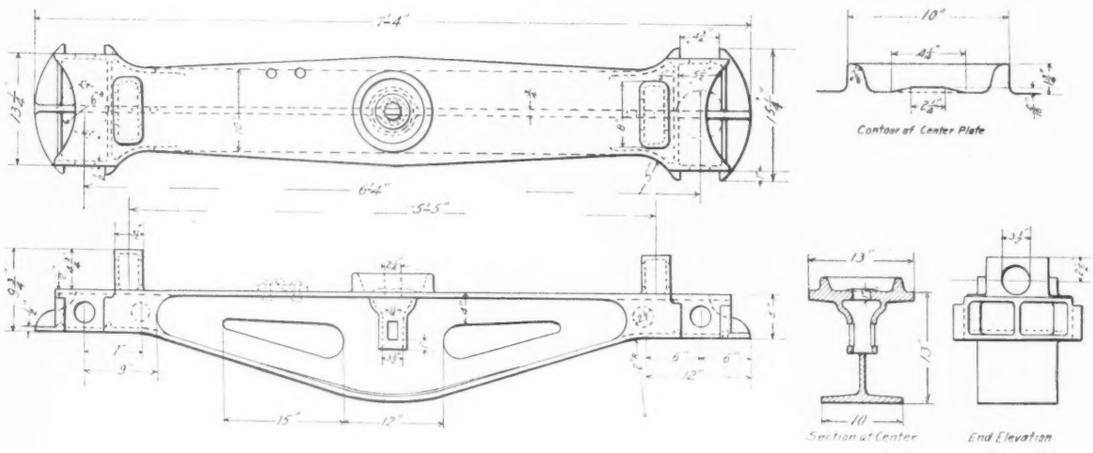
sills having lugs on it which fit into the end sill. Details of this casting, as well as of the one used for the intermediate sills, are illustrated.

The end sill is 9 ins. wide by 9¾ ins. deep. The underframing is tied together by four 1⅜ in. truss rods, and to a certain extent by the steel draft sills. This construction is simple and facilitates the repairing of both the end and the longitudinal sills, and the strength of the end is not impaired by being mortised.

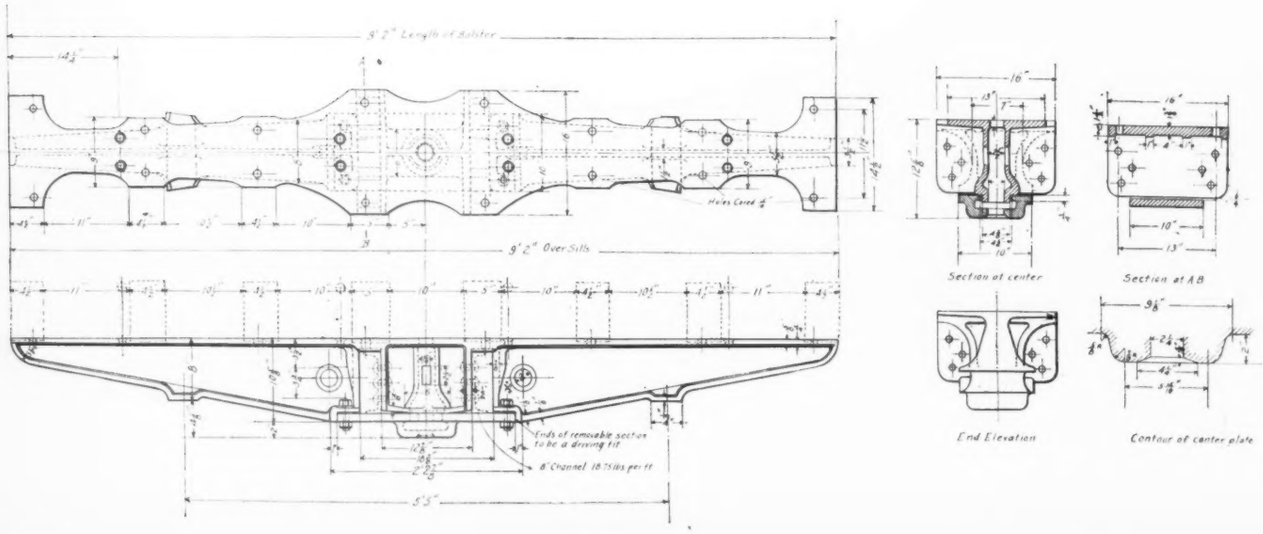
The draft sills extend the entire length of the car and consist of 8 in. channels, 21¼ lbs. per foot, each 8 ft. 10 ins. long, extending 3 ft. 10 ins. beyond the body bolster, where they are spliced to 8 in. channels, 18¾ lbs. per foot. The top of the draft sill, between the end sill and body bolster, is 1⅛ ins. below the bottom of the centre sill. A filler casting is placed between the draft sills and the end sill, and the space between this and the body bolster is filled by an oak piece, 1⅛ x 4 x 44¼ ins. Each draft sill is bolted to the end sill and to the centre sills by five 1-in. bolts, as shown on the illustration of the draft gear arrangement, and is



DRAFT GEAR ARRANGEMENT.



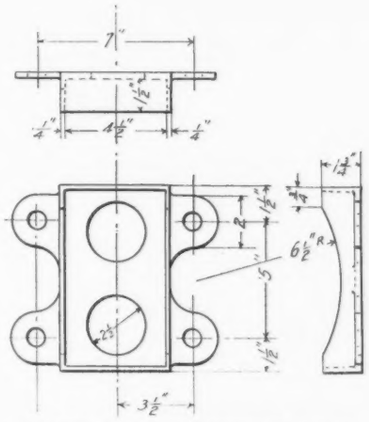
TRUCK BOLSTER.



BODY BOLSTER.

also riveted to the body bolster. These sills are very greatly stiffened by the malleable iron draft castings, which are arranged to take Miner tandem spring draft gear. The dead block is of malleable iron.

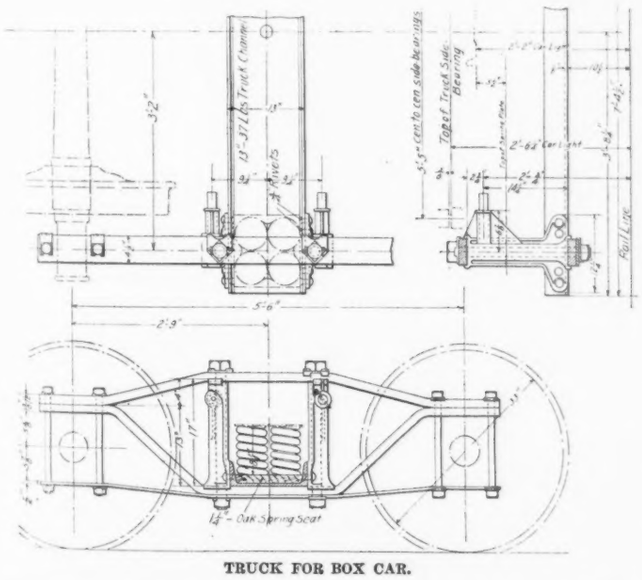
At a point near where the draft sill is spliced, about halfway between the body bolster and the needle beam, a filler-casting, placed between the draft sills, is riveted to them and is bolted to the centre sills. A somewhat similar casting is



POCKET FOR INTERMEDIATE SILLS.

used at each of the needle beams. The arrangement of the needle beams, which are 5 in., 12¼ lb., I beams, is rather unique and is shown clearly in one of the illustrations.

The draft sills will apparently have to transmit practically all of the pulling stresses, but in case of heavy buffing stresses the coupler horn will strike the buffing block and the more severe shocks will be transmitted through the end sills to the wooden sills, the draft sill, of course, carrying a part of the load. The body bolster is of steel, made by the Com-



TRUCK FOR BOX CAR.

monwealth Steel Company. As may be seen from the detail drawing, the centre plate is not cast on the bolster, and is not bolted in place until after the draft sills have been attached.

The side, corner and end posts and braces, of the sizes shown on the general drawing, fit into malleable iron pocket castings, which are either bolted or secured by lag screws to the side and end sills and plates. These posts and braces are secured to the upper pockets by carriage bolts. The framing is tied together by ⅞-in. rods, as shown. The car body is given a camber of one inch. The flooring is 1¾ ins. thick. The side sheathing and the inside lining are each 13/16 in. thick. The carlines are of pressed steel, made by the Cleveland Car Specialty Company, and are spaced at intervals of 4 ft 7 ins. A Chicago-Cleveland improved Winslow inside metal roof is used. The side doors are equipped with the National Malleable Casting Company's latch and hasp, and with the Camel Company's security door hangers. Columbia lock nuts are used throughout the car except for the column and journal box bolts in the truck.

The truck, as originally designed and as shown in the drawing, is of the diamond arch bar type with M. C. B. standard arch bars. However, on the cars now being built, solid cast steel truck side frames are being used in place of the arch bars. The steel pins which support the brake hangers are keyed in sockets cast on the column castings. The spring plank is a 13 in., 37 lb. truck channel, and the spring seat is an oak block 1¼ ins. thick. The bolster is of cast steel, with the centre plate and side bearings cast on it, made by the Commonwealth Steel Company. Simplex brake beams and Lappin chilled end steel brake shoes are used.

We are indebted for drawings and information to Mr. J. F. Deems, general superintendent of motive power.

ADVANTAGES OF REINFORCED CONCRETE.—When it is remembered that for heavy construction, where large pieces of timber form the principal means of support, the quality of material has, of late years, steadily depreciated and at the same time become more scarce, designers of industrial plants were perforce obliged to look about for some substitute that would permit of the construction of this class of buildings without materially adding to the cost and at the same time be better than the old method of construction. These conditions we find happily met in reinforced concrete, and the test of years has proven that for all types of building, and especially for the factory and warehouse class, this method of construction far outweighs, in all points, the older and less durable type of slow burning and wood constructed floors. Not only for floors and columns is reinforced concrete adaptable, but for walls as well, permitting much less material in the wall, while it gives added space for windows. This increases the brilliancy of the building, which is a most important feature in industrial plants. The chief points in favor of reinforced concrete are:

First: Reinforced concrete becomes stronger with age; slow burning becomes weaker, owing to the rotting of timbers, etc.

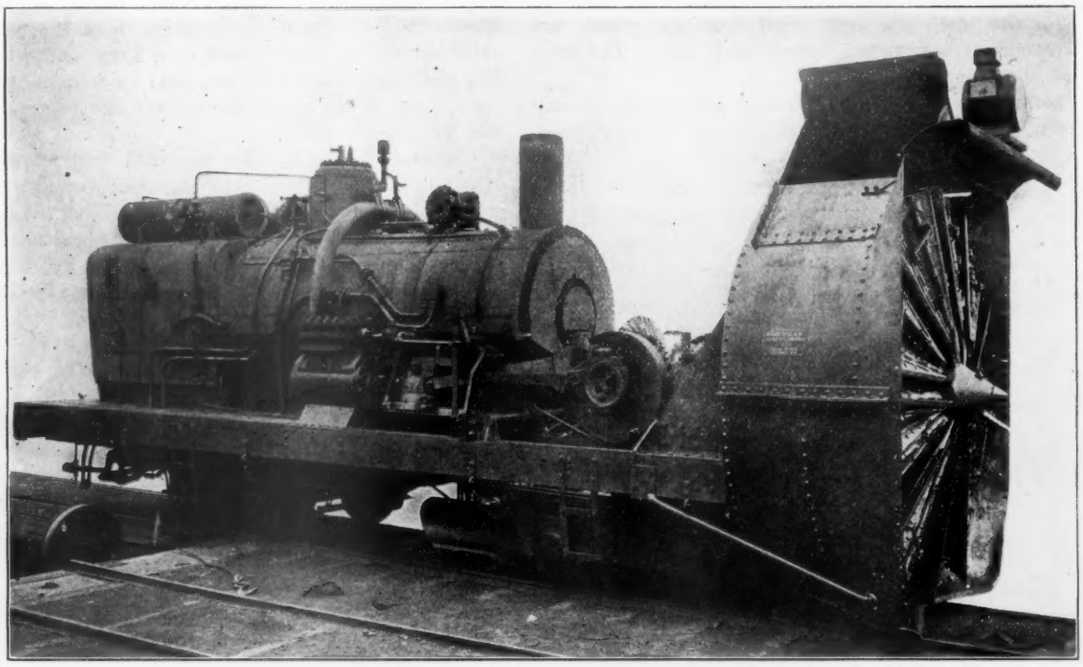
Second: Resistance to vibration, increasing the life of and lessening repairs to machinery.

Third: Low cost of insurance, and almost entire immunity from fire, thus avoiding loss of business due to shut-down of plant.

Fourth: Cheap materials and labor. Materials are found in practicality every locality.—*Mr. Emile G. Perrot in Cement Age.*

WHAT THE MECHANICAL DEPARTMENT REQUIRES OF THE STORE DEPARTMENT.—What is most needed by the mechanical man is promptness in furnishing him what he wants, when he wants it and where he wants it. This applies to cost figures as much as to castings. At Topeka the cost of repairs to each engine is carefully estimated in advance. We desire to bring immediately to gang foremen discrepancies, if any, between estimated cost and actual costs. This information is valueless to us and to them if only forthcoming at the end of a month or two months. We can go into Mr. Rice's office the day after any engine has left the shop and ascertain the total amount of materials and what kind, where used and their value, and we can also as promptly ascertain the total cost of labor repairs to any engine going out.—*Mr. Harrington Emerson, before the Railway Storekeepers' Association.*

TONNAGE MOVED.—The entire tonnage of the United States carried by the railroads one mile has nearly doubled in seven years. In 1897 it was 95,000,000,000 tons; in 1904 it was over 170,000,000,000; seven years more at the same rate of increase would mean 300,000,000,000 tons.



ROTARY SNOW PLOW WITH CAB REMOVED.

LARGEST ROTARY SNOW PLOW.

DENVER, NORTHWESTERN & PACIFIC RAILWAY.

The American Locomotive Company has recently completed at its Cooke works the largest rotary snow plow ever built, which has been delivered to the Denver, Northwestern & Pacific Railway. This plow will make a clear cut 13 ft. 4 ins. wide, and can be operated successfully through snow which has been packed and frozen until it is practically solid ice.

The general arrangement of its mechanism and also the result of its work through a very deep drift, which, as can be seen, reached fully to the roof of a passenger coach, is shown in the illustrations. The plow in general consists of a heavy steel frame mounted on two very heavy four-wheeled trucks with specially designed plate frames. The locomotive type boiler, with Belpaire firebox, is mounted near one end the frame, and furnishes steam for the two cylinders, shown on either side of the barrel, which are likewise supported on the frame. These cylinders have balanced slide valves, operated by Walschaert valve gear and drive bevel gear pinions which mesh with the bevel gear on the shaft of the cutting wheel. The construction necessitates the cylinders on either side operating in opposite directions, and the valve gear is properly connected for that purpose. The throttle and reverse levers are of locomotive type, and together with other control apparatus are located the same as in a locomotive.

The wheel consists of ten cone-shaped scoops of heavy plate, which have longitudinal openings in front and are set with the forward faces vertical. These scoops are securely fastened to the heavy cast steel hub, and also to a large steel disc forming the back of the wheel, all of which is secured to a shaft, extending back through and supported by two large pillow blocks. A bevel gear meshing with the pinions above mentioned is keyed to this shaft between the bearings. The openings of the scoops are fitted with cast steel knives, one hinged on either side of the opening, which are so connected and arranged as to automatically adjust themselves for cutting in either direction. The wheel is encased in a drum which has reversible hood at the top capable of being turned to either side by an air cylinder, to suit the direction in which the wheel is being rotated. The plates forming the drum are flanged to give an approximate rectangular cutting edge, the lower edges being specially heavy and shaped so as clear the snow very close to the rail.

The front truck of the plow is provided with both ice cutters and flangers, the former being mounted in front of the truck by a swinging frame so that they can be raised when crossing frogs and switches. They consist of heavy steel knives, projecting down just inside the rail and clearing the space for the wheel flanges. The flangers are hung at the rear of the truck and connected to bearings on the axle. Both ice cutters and flangers are raised and lowered by suitable air cylinders, and when in working order make it impossible for the plow to be derailed by ice or snow. The ice cutters are so constructed that in case they strike an obstruction such as a frog, two bolts will be sheared, allowing the cutter to swing backward and do no other damage to the truck.

The plow, as shown in the illustration, is wholly encased in a steel cab with suitable door and window openings, there being a floor placed over the bevel gear mechanism, and a

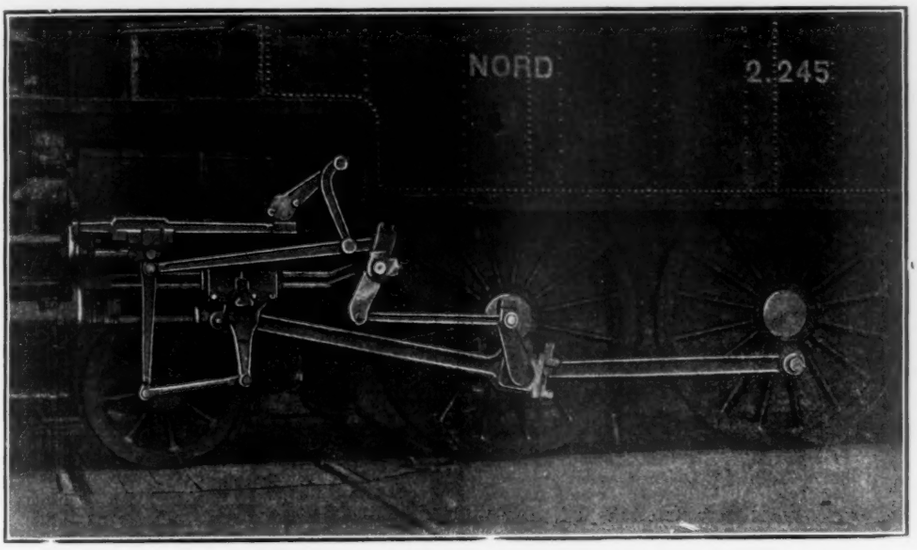
CUT MADE BY ROTARY SNOW PLOW.

cab arranged at that point for the pilot who controls the work by signalling the engineer of the plow and the pusher engine during the operation. The rear of the cab is suitably arranged for the engineer and fireman, there being a regular locomotive tender attached for coal and water supply. A turbine generator furnishes current for electric headlights and cab lights.

CAST STEEL CRANK AXLES, RODS AND VALVE GEAR.

NORTHERN RAILWAY OF FRANCE.

Nearly four years ago the Northern Railway of France started a series of experiments in the use of cast steel for locomotive parts which previously had been and usually are now made of forged steel or iron. At that time and subsequently the following parts made of cast steel have been applied to several different classes of locomotives: Main rods, side rods, crank axles, eccentric blades, guides, Walschaert valve gear parts, as well as driving boxes, piston heads, guide yokes, and other similar pieces. The results in service, covering various lengths of time up to four years and more, are reported as being uniformly favorable.

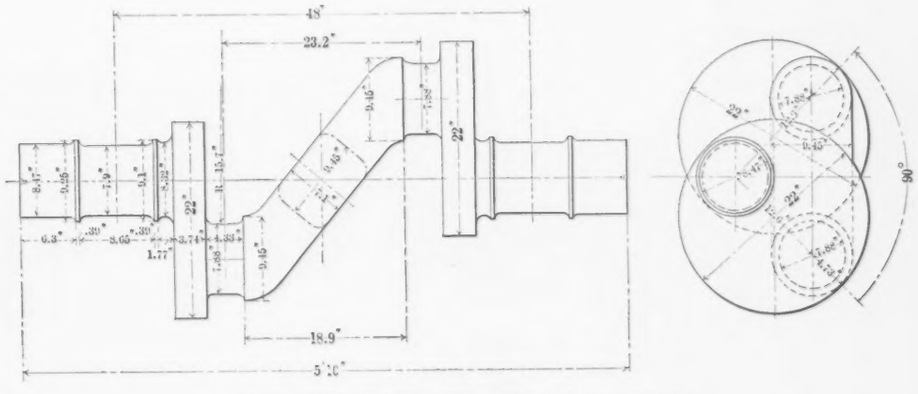


CAST STEEL RODS, GUIDES, VALVE GEAR, ETC., ON FRENCH LOCOMOTIVE.

The points of greatest interest in these experiments lie in connection with the rods and cranked axles, and through the courtesy of M. Sartiaux, chief engineer of the railway, we are able to illustrate the construction of these parts.

While the locomotives on which these experiments have been conducted are comparatively small, still for similar service they are comparable with locomotives on American railways. The cranked axles have been applied in two different types; one a ten-wheel balanced compound locomotive having a tractive effort of 16,450 lbs. and an Atlantic type, also a balanced compound, having a tractive effort of 14,150 lbs. The former of these employed the crank axle with the oblique centre section and circular cheek plates, while the latter uses the design with elliptical cheek plates and straight centre section, both of which are shown in the illustrations. It will be noticed that the design of these axles closely follows the usual construction with forged steel, with the possible exception that the fillets are made of a larger radius. The main rod bearings in both cases are of the convex type, which is being used somewhat extensively abroad. The axles are, of course, cast in one piece and machined only where necessary for bearing surface or fits. We are informed that an axle of the oblique type has now made a mileage of over 88,000 miles in one case and over 37,000 on another locomotive, and an axle of the elliptic type has made a mileage of over 85,000 miles, and in all cases there is no evidence at present of any fault or imperfection of any kind.

The side and main rods were applied to a 4-4-4 type suburban tank locomotive with cylinders 17 ins. in diameter, stroke about 22 ins. and a 170 lbs. steam pressure, driving wheels being 66 ins. in diameter and carrying a weight on drivers of 71,000 lbs. This same locomotive, as can be seen in the reproduction from a photograph, also had all of the levers forming the Walschaert valve gear made of cast steel, as well as the guides, cross head, brake rigging, etc. The main rod follows the construction usually employed with forged steel and is nearly 4 ins. deep at the wrist pin and enlarging by means of an increase in the thickness of the flanges to 4¾ ins. near the crank pin. It has a uniform width of about 2⅝ ins., the web being nearly 13/16 in. thick. The rod measures from centre to centre about 5 ft. 4¼ ins. The side rod is of similar construction and has a

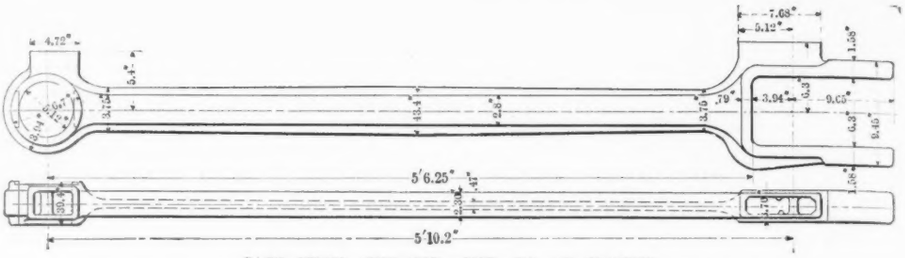


CAST STEEL CRANK AXLE—NOR. RY. OF FRANCE.

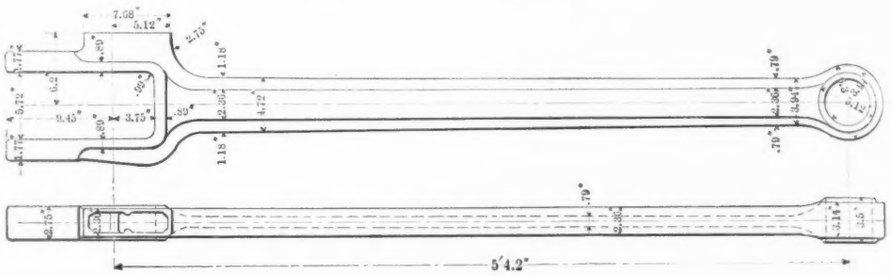
CAST STEEL CRANK AXLE—NOR. RY. OF FRANCE.

forked end with wedge and key on the main pin. It is made slightly deeper in the centre and slopes away to 3¼ ins. in depth at either end. This construction is clearly shown in both illustrations.

In speaking of this locomotive the "Revue Générale des Chemins de Fer" states that since going into service this engine has made a mileage of about 56,000 miles up to May 12, 1906, at which time its machinery was in good condition and showed no trace of cracks. The right side rod after a service of about 18,000 miles showed a very small crack, less than an inch long, at the fillet, where the body of the rod joins the larger end. Repairs were made by welding in a small piece of wrought iron at this point and the rod was again put into service and has since shown no cause for comment, being perfectly sound.



CAST STEEL SIDE ROD—NOR. RY. OF FRANCE.

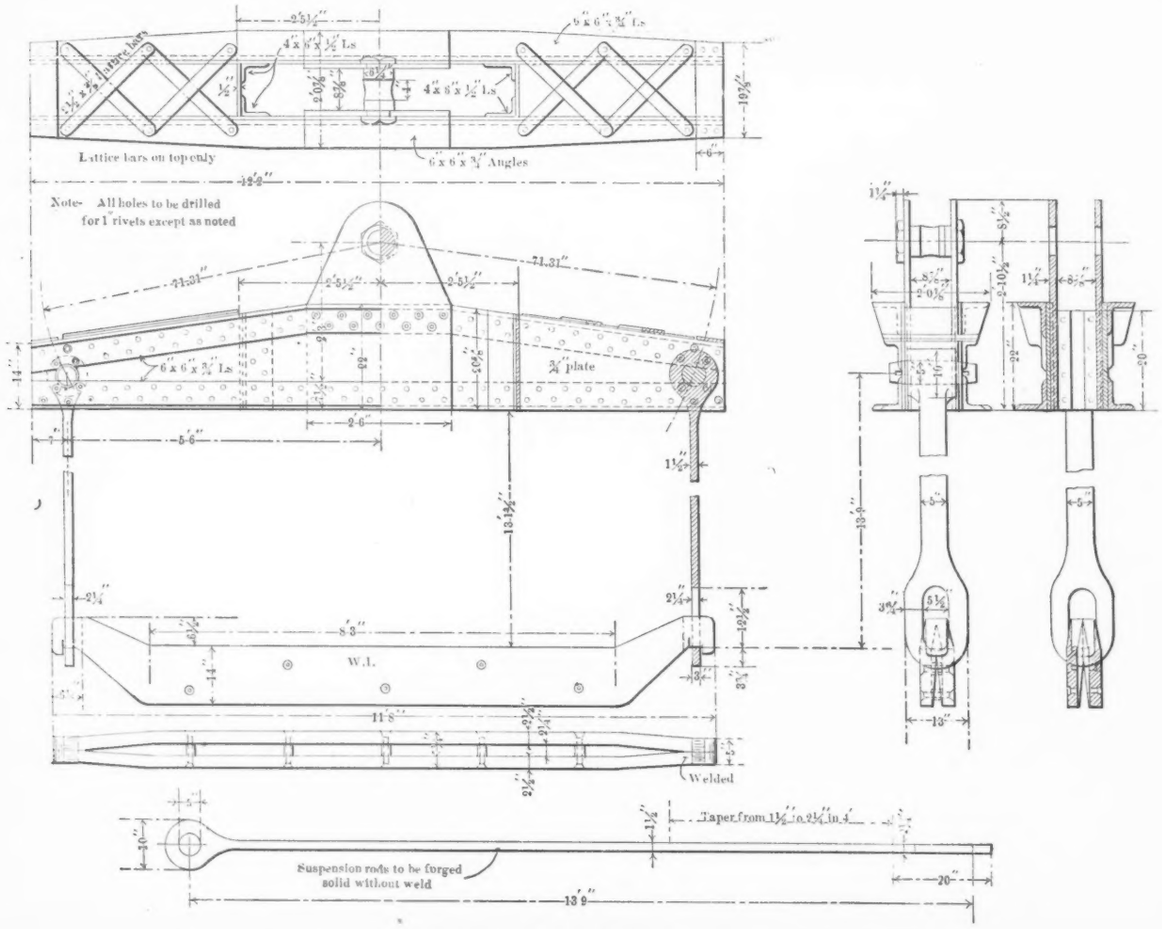


CAST STEEL MAIN ROD—NOR. RY. OF FRANCE.

We are unable at present to obtain the chemical and physical properties of the material used in these experiments, but from experience in other lines of work where similar material has been imported from France, as well as observations of French locomotives in this country, we would judge that the cast steel used is of a considerably higher grade than that ordinarily employed here. However, its use in connection with the valve gear at least would seem to be possible and might be advisable in some cases in this country.

LOCOMOTIVE CRANE LIFTING BEAM, SLING AND DOUBLE HOOK.

The accompanying engravings show the lifting beam for the rear end of a locomotive and the double hook and sling for the front end, as used with the 120-ton locomotive crane in the McKees Rocks shops of the Pittsburg & Lake Erie Railroad. The lower member of the lifting beam rests underneath the rear end of the frame, and the suspension rods and upper member or girder clear the sides and top of the

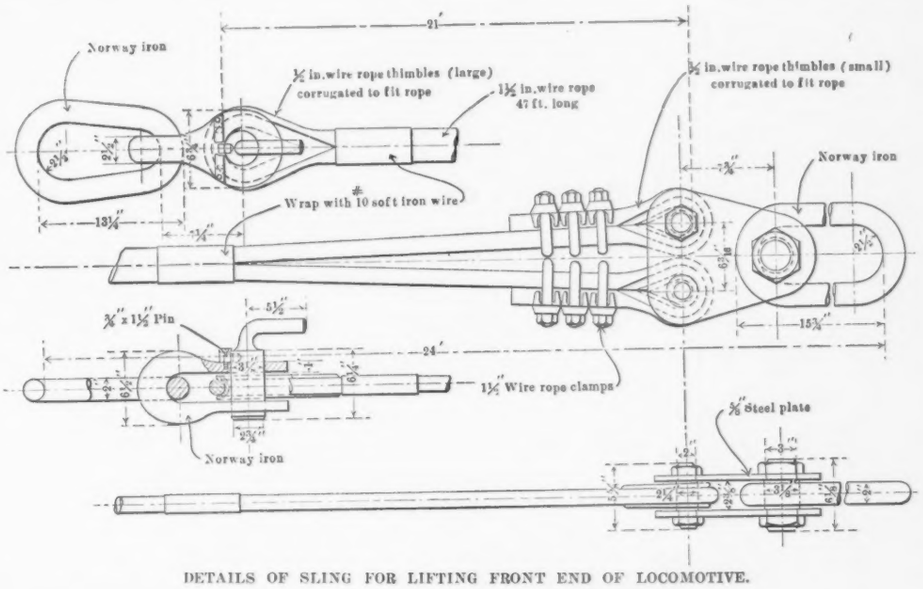

Lattice bars on top only
6" x 6" x ¾" Angles
Note- All holes to be drilled for ¾" rivets except as noted
¾" plate
W.I.
Welded
Taper from 1½" to 2¼" in 4'
Suspension rods to be forged solid without weld
13'9"

LOCOMOTIVE CRANE LIFTING BEAM.

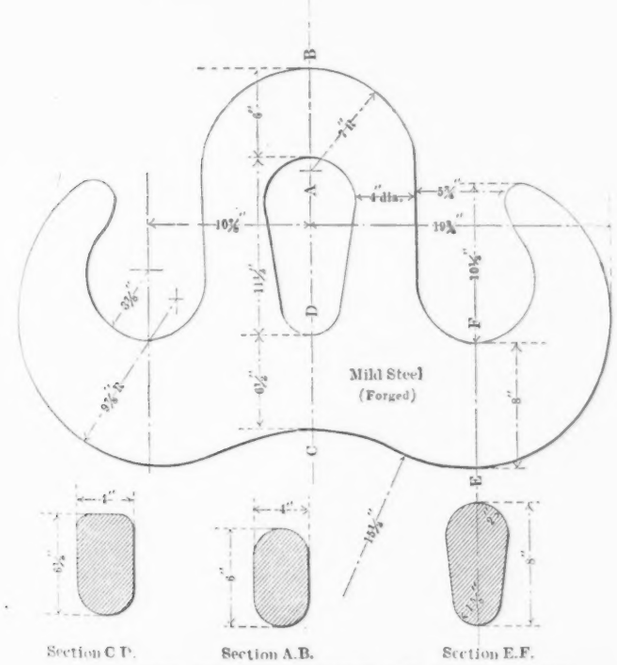
largest locomotive cab by several inches. The crane hook engages the 6¼-in. pin in the top girder. This lifting beam has a working capacity of 60 tons.

In lifting the front end the double hook is placed on the crane hook and the heavy cable sling, with links at each end which fit on the double hook, is passed under the front end close to the cylinder casting. The sling is made from a piece of 1½-in. steel wire rope 47 ft. long, which is passed through a thimble connecting with two links which form one end of the sling. The two strands of the rope are wrapped with No. 10 soft iron wire for several inches close to the thimble. The two ends of the rope are passed through thimbles and securely clamped with 1½-in. wire rope clamps, as shown. These two thimbles are connected by two 2¼-in. pins to the ⅜-in. steel plates, which are in turn connected by a 3⅛-in. pin to the large link.

A framework has been erected at one end of the shop upon which the lifting beam, double hook and sling can be hung when they are not in use, so that the crane may be used for other purposes.


Norway iron
1½ in. wire rope thimbles (large) corrugated to fit rope
1½ in. wire rope 47 ft. long
½ in. wire rope thimbles (small) corrugated to fit rope
Norway iron
Wrap with 10 soft iron wire
¾" x 1½" Pin
1½" Wire rope clamps
⅜" Steel plate
Norway iron

DETAILS OF SLING FOR LIFTING FRONT END OF LOCOMOTIVE.



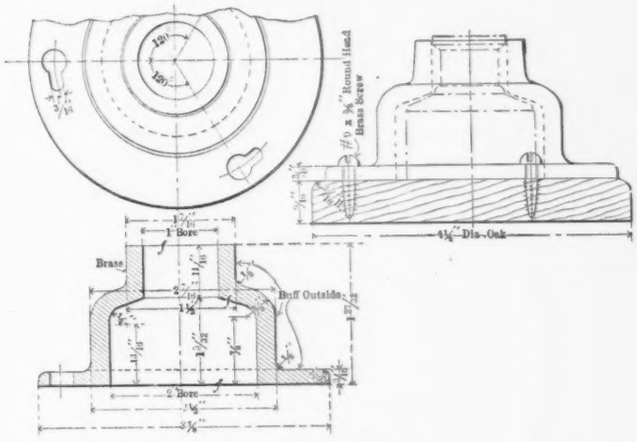
DOUBLE HOOK FOR LIFTING FRONT END OF LOCOMOTIVE.

THE RAILWAY SIGNAL ASSOCIATION.—A stated meeting of The Railway Signal Association will be held at the Great Northern Hotel, Chicago, March 18. The subjects for discussion during the forenoon are, general specifications for electric interlocking and the installing and maintenance of storage batteries. During the afternoon the design of signal lamps and the report of a special committee on interlocking and block signals will be considered.

SUPERHEATERS.—The total number of locomotives equipped and in the course of construction having the Schmidt superheater was 1,664 on October 10. Fifty-one railroads are now using it, mostly in Continental Europe.—*Machinery.*

INK BOTTLE HOLDER.

The ink bottle holder illustrated herewith has been in use in the drawing room of the Illinois Central Railroad for several years and there is no record of one of them being upset, with the consequent spilling of ink. The thickness of the metal in the brass top is such as to insure stability and adapt the holder for a paper weight. The slotted holes in the flange of the metal case permit it to be revolved and removed whenever it becomes necessary to remove the ink bottle for cleaning. We are indebted to Mr. W. O. Moody, mechanical engineer, for drawings and information.



INK BOTTLE HOLDER.

CO-OPERATION.—Frequently problems or instructions are presented to the practical man for execution, in language or by formula which he does not understand, although he may know thoroughly well how the operation should be performed; a sense of wounded pride or humiliation prevents him asking for information, and sometimes a feeling of superiority prevents the theoretic man from either placing the problem in easier terms to be understood, or going in person and making such explanations as would be helpful to both. This together with many other similar circumstances all tend to prevent that bond of union or good fellowship between the practical and theoretic man, which should exist and which is essential to a high standard of ability or efficiency in men of either class.—*Mr. W. E. Symons at Purdue University.*

Take your time—but do not take the other fellow's.

(Established 1832).

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Contributions.—*Articles relating to railway rolling stock construction and management and kindred topics, by those who are practically acquainted with these subjects, are specially desired. Also early notices of official changes, and additions of new equipment for the road or the shop, by purchase or construction.*

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We are doing our best to make this journal of the greatest possible value to our readers and are always grateful for suggestions as to how we may better meet your needs. If we are not giving you what you need most, or are not doing things the way you think we ought to do them, let us know. Frank criticisms, as well as suggestions, are always welcome. We want every reader to feel that he has an interest in the paper and to co-operate with us in every way possible. We are able to visit personally only a comparatively small part of the field each year and must rely, to a large extent, upon you to keep us in touch with the important work you are doing.

The extract at the end of this editorial is taken from a specification for a lot of freight cars prepared by Mr. G. R. Henderson, consulting engineer. It is rather unusual, strange as it may seem, to state definitely the amount of the stresses which are to be provided for in designing freight cars. The ordinary specifications, where the car company is to design and build a car to meet the railroad company's requirements, deal quite largely with glittering generalities and a statement as to the specialties which are to be used on the car.

Any statement as to allowable fibre stresses is usually confined to those caused by the lading and the dead weight of the car. In spite of the fact that more or less is known as to the pulling and buffing stresses to which the car is ordinarily subjected it is not usually referred to in the specifications, and it is a question as to whether the average car designer has attempted to any great extent to analyze the effect of these stresses in combination with the vertical stresses due to the lading and to the dead weight of the car. From a discussion which took place at one of our railroad clubs it is even a question as to whether the average car designer knows how to intelligently analyze and determine the effect of the combination of these stresses. It is a fact that some of the most radical improvements which have been made in steel car design were suggested as the result of careful investigation into this subject along the same lines as pursued by the structural engineer. Undoubtedly the railroads would be benefited if a clause similar to that used by Mr. Henderson was incorporated in their car specifications and the finished designs were carefully checked over to see that they agreed with this part of the specification.

"The body is to be proportioned for carrying 125,000 lbs., uniformly distributed between the bolsters, in addition to the dead weight of the car. The center sills and draft attachments must be proportioned for a force of 100,000 lbs. pulling and 200,000 lbs. buffing, and strains due to either or both the horizontal forces and the vertical loading combined must not exceed 12,000 lbs. per sq. in. in tension (net sectional), or 12,000—(70 l ÷ r) in compression, where l = length and r = the radius of gyration, both in inches."

"Nevertheless every railroad in the country goes on piling up figures which are meaningless and which are not and cannot be used for the only purpose for which they should be made, viz., to make it possible to determine with approximate exactitude the relation between the cost and the selling price."

"A great many of them were legitimate enough after they were inaugurated, but the necessity for them is past, and they are still kept up as a matter of form."

These two sentences are taken from some remarks which were made by Mr. J. W. Kendrick, second vice-president of the Santa Fe, in discussing a paper on "Railroading From a Business Point of View," recently presented before the New York Railroad Club. That a large proportion of the data which is worked up in the mechanical departments of some of our railroads is of very little use, and some of it entirely worthless, and that an equally large amount of data which should be had is not available, is a matter for serious comment. Consider, for instance, the important matter of engine performances. The superintendent of motive power has just received his monthly report, as you enter his office, and

certain figures are pointed out to you as being specially gratifying. As you look over the sheet you notice some figures that appear to be abnormal. You ask certain questions about them and a clerk is called in to tell just how they were obtained. He does the best he can to give you a good reason for the method by which they are derived, but finally it is admitted that some one at some time or other did it that way and the precedent has been followed ever since. As you examine the report further you find other things that do not look quite right, and after more questioning you are forced to the conclusion that as far as giving a true idea of the actual condition of affairs a considerable part of the report is not only worthless but misleading. Why does this condition exist? As nearly as you can find out it is not because the figures are being juggled to make a good showing, for in some cases the effect is just the opposite, but simply because it has always been done that way.

You inquire for certain data as to the cost of operation of a department and find that the records are in such shape that it is not available, even though it may be a matter of considerable importance. In some instances you find very complicated systems for keeping and compiling information which could just as well be obtained by an easier and simpler method. Such a condition is, indeed, deplorable, and it is hard to know how any motive power officer can expect to make a record under such conditions. It must, of course, be admitted that this condition does not exist on all railroads, but it is known to be true on a considerable number of them.

On the other hand, suppose the records are really reliable and give information showing clearly the actual conditions which exist. The motive power officer is a busy man and he can digest and keep in mind only a comparatively small amount of the important data concerning his department. Few men are capable of looking over a comparative statement containing many figures and readily grasping their import without a considerable amount of study. The officer's energy will be conserved and his efficiency greatly increased if such comparative figures are plotted graphically, so that a few minutes' study will enable him to gain an intelligent idea of the progress which is being made as compared with previous records. The superintendent of motive power or the division officer can have at a moment's command all of the important information concerning his road or division by having the important records plotted graphically in a small book, which can easily be carried in the side or breast pocket. If the records of his department are such that the figures are available it requires only a little work on the part of his chief clerk or one of the clerks to keep a book of this kind in good condition and up to date. It is gratifying to know that these graphical note books are being used quite generally, with splendid results, by the motive power officers on two or three large roads.

The subject of electrification of steam railroads has been a most attractive one for electrical engineers for several years past, and many papers have been written and presented before different societies, or in technical papers, bewailing the shortsightedness of steam railroad managers in not immediately changing their motive power. These have usually confined themselves to the handling of passenger traffic only, and, so far as we know, the paper of Messrs. Stillwell and Putnam, presented at the January meeting of the American Institute of Electrical Engineers, is the first attempt to prove the advisability of handling all kinds of traffic throughout the country by electric power. The paper takes the average percentage figures for each item of steam railroad maintenance and operation for five years as given in the reports of the Interstate Commerce Commission, and considering each item at some length, shows the decreased or increased cost probable with electric locomotives and cars operated on the single phase alternating current system. The final result derived is that such a change would save $250,000,000 a year in the cost of operation of our railroads. The method of treating the subject and the results obtained were apparently satisfactory to the Institute, at least there was no criticism heard at the meeting, but from a railroad standpoint they were sadly unconvincing for a number of reasons, not the least of which is the basing of the deductions on the figures given in the Interstate Commerce Commission reports, which are altogether too much condensed and general for any such purpose. For example, every railroad man knows that by no means all the coal charged to locomotives finds its way into the firebox or even on the tender. In some cases this same coal furnishes power to run shops, heat roundhouses and stations, dry sand, etc. Again the item "repairs and renewals of locomotives" includes many things in no way connected with locomotives. The same thing is true of many other items.

It apparently depends altogether on what you want to prove and your point of view as to what results you obtain from a comparison of the cost of steam and electric operation. For example, take it from a power standpoint. A horse power in the shape of a steam locomotive costs about $10.00 in round numbers. A modern power plant and permanent over-head structure costs about $100.00 a horse power in round numbers, and assuming that the total horse power of the plant will be equivalent to 40 per cent. of the horse power necessary in the shape of steam locomotives, this will make the power cost on the same basis at $40.00 for the electric permanent equipment. Electric locomotives will cost about another $10.00 a horse power, and in spite of the idea that there will be fewer locomotives required under those circumstances, any one familiar with the empty condition of roundhouses at periods of congestion will understand that fully as many electric locomotives as steam would be required to handle the traffic. This makes the first cost in the shape of a steam locomotive at $10.00 a horse power and $50.00 a horse power for electric, which at 5 per cent. capital charge and 5 per cent. depreciation and renewal charge makes a permanent cost of $1.00 per horse power year for steam and $5.00 for electric. As to operation, a horse power at the electric locomotive will cost about 6 mills an hour if the power plant load factor is maintained fairly high and constant. A horse power at the cylinders of a steam locomotive can be obtained ordinarily for about 4 lbs. of coal if the machine is properly handled, which, with coal at $2.00 a ton, would cost 4 mills; water will cost about 7 per cent. of the coal or three-tenths of a mill. It will further cost, at a maximum, 10 per cent. of the total coal bill to build and maintain coaling stations, which makes the horse power of a steam locomotive cost 4.7 mills per hour, but, of course, it takes coal to fire up locomotives, and they further burn coal while standing, and assuming that 25 per cent. of the total amount converted into horse power will cover this it gives practically 6 mills per horse power for operation, or the same as for the electric locomotive. It is, therefore, necessary to save, in some manner, $4.00 a horse power year on the basis of the combined horse power of the present steam locomotive equipment in order to arrive at the same cost of transportation. This appears quite different from the results obtained in the paper mentioned, but the assumptions and deductions made are at least fully as accurate.

There have been, and are being, several sections of steam railroad changed from steam to electric operation, and from the statements of the men responsible for such work, we would judge that their ideas on the subject are very clearly expressed by Mr. Aspinall when he stated before the International Railway Congress that his road (the Lancashire & Yorkshire) adopted electricity, "not to save money, but to make money." The inference from this, of course, is that the advantage of electricity for motive power is in the increased traffic attracted and the increased capacity of passenger terminals and tracks, and not at all in a decreased cost of operation for the present traffic. This we believe to be the true facts of the case, and that it is altogether idle and useless to attempt to prove the advisability of electrifying any and all the steam railroads in the country.

BETTERMENT WORK ON THE SANTA FE.

To THE EDITOR:

In the elaborate article on "Betterment Work On The Santa Fe" in your December issue you explained at length, both by the use of graphical charts and actual figures, the exact saving to the company due to the introduction of betterment work and the bonus system. While a very considerable amount of space was devoted to a statement, in general terms, of the benefits gained by the workman due to the bonus system there was very little or practically no definite information as to just how much his wages had actually been increased. The following statement is made on page 452: "Thus far the betterment work on the Santa Fe has materially assisted in restoring harmony between the employer and employee and in greatly increasing the efficiency and reliability of the worker. His wages have been increased on an average from 10 to 20 per cent."

Those who are familiar with the question of wages in the western part of the country must realize that there has been a considerable advance in wages during the past few years, and that taking this into consideration the actual gain on the Santa Fe may really have been much less than indicated by the above statement. As a machinist I have been very much interested in your account of the bonus system, and while it would appear to afford many advantages to the workman I should like, if possible, to obtain some definite information as to the actual financial gain which a workman might expect in a shop where this system was to be introduced.

SHO-ME.

To THE EDITOR:

Referring to Sho-Me's well raised question as to whether the general increase in wages throughout the West was not equal to the increase in pay of those earning bonus on the Santa Fe. The straight hourly rate of pay at the Topeka Shop is equal to that paid the same class of labor in this territory. In addition to this men earn extra money in the form of bonus.

Straight rate of pay has been advanced voluntarily by the Company with the general increase in wages throughout the West.. Following is a table showing rate of pay per hour with and without bonus since the year 1904. This is the actual record of eight men now in the shop. It is obviously best not to designate them by name:

Man No.	Occupation.	1904. Rate per hour.	1904. Rate per hour including bonus.	1905. Rate per hour.	1905. Rate per hour including bonus.	1906. Rate per hour.	1906. Rate per hour including bonus.	1907. Rate per hour.	Per cent. 1906 monthly pay was to 1904 monthly pay.
1	Machinist	34	34	34	48	34	47.8	36	110
2	"	34	34	34	41.9	34	41.4	36	115
3	"	34	34	34	38.5	34	40.4	34	119
4	"	34	34	34	41.2	34	54.5	36	123
5	"	34	34	34	39.9	34	38.3	36	126.4
6	"	34	34	34	41.4	34	43.7	36	108.4
7	"	30	30	30	36.5	30	37.8	34	115
8	Helper	19	19	20	21.7	20	23.4	20	121.6

In 1904 the day was of 10 hours and there was a great deal of overtime. In 1906 the day was for several months 9 hours and there was virtually no overtime. The last column shows the increase in actual earnings in 1906 above 1904, the hourly rate not having changed, there being no overtime and the work day considerably shorter. In 1907 the hourly rate of pay was increased, but the hourly rate has nothing to do with bonus schedules or bonus earnings.

At some of the large shops and over the system as a whole the following is the December, 1906, record:

Shop.	No. of men working bonus.	Per cent. of increase of pay while working bonus.	Total bonus payments.
1	294	18	
2	482	13.4	
3	714	13.2	
4	800	22.3	
			$13,107.93
Other shops.	1169	12	$3,919.72

If the company has profited by lowering the cost of output, by not having to increase its shops and their equipment, by turning out work in shorter time, the workers have benefitted by

Not having to work overtime.
By working shorter hours.
By earning more money per hour.
By earning more money absolutely.

H. EMERSON.

EQUALIZERS ON PASSENGER TRUCKS.

To THE EDITOR:

Can you tell me whether there is any good reason why the equalizer is retained in American passenger trucks? It has seemed to me that the equalizer is very heavy and is a detriment rather than an advantage: that if the wheel-pieces are as stout as they should be to stand ordinary derailments, they might be given the duties of the equalizer without being made any heavier; and that the helical equalizer springs, placed so far from the end of the truck, give rise to those vibrations to the whole truck frame, which often make themselves so disagreeably perceptible in the car. On the other hand, the lightness, simplicity, and good riding qualities of the European truck are very attractive. I have sought by verbal inquiry and by book research for some time to find something in favor of the equalizer, but without success. While the details of construction have been more or less carefully studied, I have not found that designers have gone deeper into the general principles than to follow the customs of their predecessors. Can you enlighten me on this point? G. E.

THE FUTURE LOCOMOTIVE IN EUROPE.

It is interesting to note how the locomotives on both sides of the Atlantic, which, while starting from the same point, have widely diverged in matters of general design, as well as details, are now gradually becoming more and more nearly alike. This is due in some cases to the adoption in this country of features which have been long used on foreign railroads, notably the Walschaert valve gear and balanced compound, and much more to the increased traffic requirements on foreign roads making it necessary to design locomotives of a weight and power which were demanded in this country several years ago.

The following general conclusions as to the future European locomotive are taken from "La Locomotive Actuelle" (the modern locomotive), by Maurice Demoulin, mechanical engineer of the Western Railways of France, and show that the tendency points very clearly to a design which in its general features will be the same as is at present in general use for different classes of service in this country.

"The present tendencies, which are becoming more and more marked, and allow some fairly definite conclusions as to the future development of the locomotive to be drawn, may be summarized as follows:

1. Perhaps before long, general use of wide fireboxes, with a grate area of 37 to 48 square feet, with large heating surfaces, either of the Belpaire type, or with curved top, as much curved as possible or combined with the wagon-top which appears to be an interesting and possibly indispensable addition, will be made.

2. Return to smooth tubes in the case of boilers with long barrels. Adoption of heating surfaces proportional to the grate area; say 3,229 square feet and upwards.

3. Gradual increase in the adhesive weight, either by increasing the wheel-loads, when possible, or by increasing the number of coupled wheels. Locomotives for fast trains will thus probably more and more generally have six-coupled wheels, unless it proves possible to design Atlantic types having an adhesive weight of at least 40 tonnes.

4. The preceding conditions will before long involve, in Europe, the adoption of Pacific or Prairie types for high speed trains; such types will make it possible to have six coupled wheels, of large diameter, and wide fireboxes.

The Atlantic type, if still made in the future, will necessarily include the wide firebox; the possibility of using this constitutes the principal advantage of this type of locomotive.

In the case of the freight service, the consolidation type would appear to meet, for a long time to come, the requirements of the service; but it is equally probable that the use of the wide firebox, or at least of an enlarged firebox, with the barrel raised a corresponding amount, will become more and more general.

5. It also is probably possible to forecast the general development of a four-cylinder engine with the same number of cranks, either on the same axle or on two separate coupled axles. These engines may be expected to be normally of the compound type in spite of the present tendency of some makers to have simple engines with four cylinders. The latter type will not become more general unless the use of superheated steam, becomes developed to the extent expected by those who favor it.

As regards compounds, a general increase in the ratio of the high pressure to the low pressure cylinders may be expected. As a consequence of this increase (2.8 to 3 volumes) the valve gears may be connected, or even only two valve gears may be used; this simplification would be bound to become more and more general.

To sum up: however powerful and perfect the present locomotive may be, it can as yet only be considered as at one of the stages in its evolution, the further development of which it is easy to foresee."

COST OF MAINTAINING LARGE LOCOMOTIVES.

The yearly figures on locomotive repair costs from four large single track systems operating west of Chicago, which have greatly increased the size of their power within the last few years, are given in the following table:

Year.	No. Engines Owned.	Average Tractive Power lbs.	Repair Cost per Engine Mile	Repair Cost per 1000 lbs. Tractive Power per Mile.
		A.		
1903	1309	22,526	9.97 cts.	.4426 cts.
1904	1433	25,578	13.42 cts.	.5247 cts.
1905	1454	26,217	14.87 cts.	.5710 cts.
1906	1633	27,684	11.08 cts.	.4002 cts.
		B.		
1903	586	20.268	6.01 cts.	.2965 cts.
1904	731	21,261	7.56 cts.	.3556 cts.
1905	770	22,452	7.37 cts.	.3282 cts.
1906	800	23,112	7.82 cts.	.3383 cts.
		C.		
1903	929	19,832	7.68 cts.	.3879 cts.
1904	1191	21,470	9.64 cts.	.4301 cts.
1905	1234	22,095	10.65 cts.	.4816 cts.
1906	1257	23,430	6.86 cts.	.2932 cts.
		D.		
1903	1482	22,857	8.62 cts.	.3771 cts.
1904	1567	23,950	10.23 cts.	.4312 cts.
1905	1703	25,685	11.23 cts.	.4371 cts.
1906	1671	27,500	11.26 cts.	.4095 cts.

The different railway systems are simply indicated by letters, in order to avoid any invidious comparisons, though the comparison of the figures of one system with those of another would not be made or considered of any value by anyone familiar with the extreme variations between different systems in the matter of distributing accounts. The points desired to be brought out dwell within the figures of each system by itself.

For example, on system A, the addition of 324 very heavy locomotives (in addition to the equivalent supplanting of the usual percentage of light power destroyed or sold) within four years, has increased the average tractive effort per engine from 22,526 to 27,684 lbs., or 5,158 lbs. per engine—or, the locomotives at present in service average 22.9 per cent. greater in tractive effort than in 1903. Shop labor troubles vitiate the repair cost figures for the years of 1904 and 1905, but with the system settled down again in 1906 the repair cost per engine mile of 11.08 cents may be taken as normal. But here we see that although this figure is 11.08 cents for 1906, as compared with the 9.97 cents for 1903, that really the repair cost of the tractive effort provided for producing transportation was less in 1906 than 1903, or .4002 cents as compared with .4426 cents per 1,000 lbs. of tractive effort per mile. In other words, the larger locomotives cost less to keep in repair than the previous lighter classes, though this result is due in some measure to a considerable modernization of shop facilities,

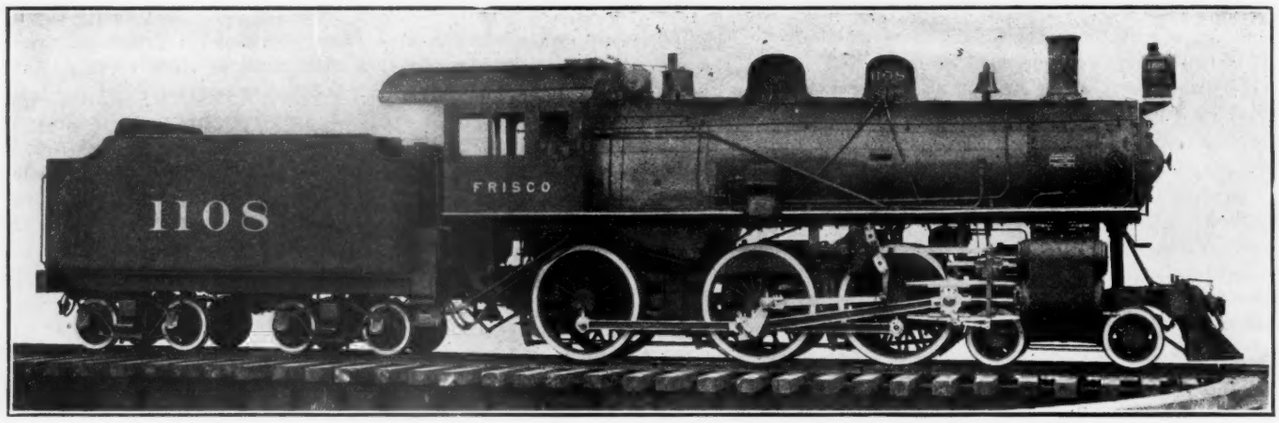
On system B, a lighter class of power is dealt with and the average tractive effort per locomotive has been increased but 13.4 per cent. Here we see that although a comparison of the year 1906 with 1903 apparently involves an apparent increase in repair costs chargeable to the increase in the size of the power, yet it will be noted that the immediate effect of the large increase in both size and number of the locomotives introduced in 1904 has been considerably reduced since—if we regard the preferred figures in the last column instead of cost per engine mile. The cause of the immediate jump upward in 1904 was lack of shop and roundhouse facilities for dealing with the new and heavy power.

On system C, an increase of 18.1 per cent. in the average amount of tractive effort per engine, while causing a similar first increase in repair costs, has eventually resulted in their reduction, to an even greater extent than is exhibited on system A. In this system also, the modernization of shop facilities has been a considerable element in the reduction of repair costs.

On system D, the weight of the power dealt with greatly resembles system A, and the amount of increase in the average amount of tractive effort is very similar, being 20.3 per cent. The shop facilities on this system have not been modernized to the extent found on systems A and C, but its repair cost exhibitions resemble the experience of all three of the others, in the introduction of heavier power at first raising the figures—with a final drop to a normal which is not an increase over that of the lighter power, if we consider the increases in the costs of material and labor during the last few years.

These exhibits would seem to imply that, if we estimate our repair costs on the fair basis of the amount of tractive power made available to the transportation department, the introduction of heavier locomotives on a railway system will cause repair costs to rise, until equivalent shop facilities have been provided. After which the repair costs will soon drop to, or even below, a level with the repair costs previously exhibited by the smaller power—which level, in view of the present increased costs of material and labor, implies that the larger locomotives are less expensive to maintain than the previous smaller ones.—*Railway and Engineering Review.*

THE ECONOMY OF HIGH SALARIES.—In the first place, salaries and wages are too low. I am no advocate of increased pay rolls. But it is shown in practice that five men worth $4.00 a day each can do as much as ten $3.00 men, and the same is true of a foreman earning $80.00 or $90.00 compared to one earning $150.00 to $200.00; or of an official belonging to the $200.00 class compared to one belonging to the $600.00 class. The high priced man is not necessarily the best; but for the high price the best can be secured. It is manifestly false economy to pay a master mechanic $175.00 a month, and give him charge over one thousand or two thousand men with an aggregate pay roll of $60,000 to $100,000, when an intelligent $300.00 man, bringing perhaps in his train a $500.00 staff of assistants and specialists, can in six months lop off 15 to 30 per cent. of this pay roll, and at the same time by system and specialization and a method of reward according to merit, give increased and better service. Similarly, a $90.00 foreman is not an economical man to whom to entrust the requisitioning of thousands of dollars' worth of material each month; he will generally order perfunctorily and far beyond his needs, and it is not usual for his requisitions to be effectively checked up.—*Mr. H. W. Jacobs in The Engineering Magazine.*



TEN-WHEEL LOCOMOTIVE—ST. LOUIS & SAN FRANCISCO RAILROAD.

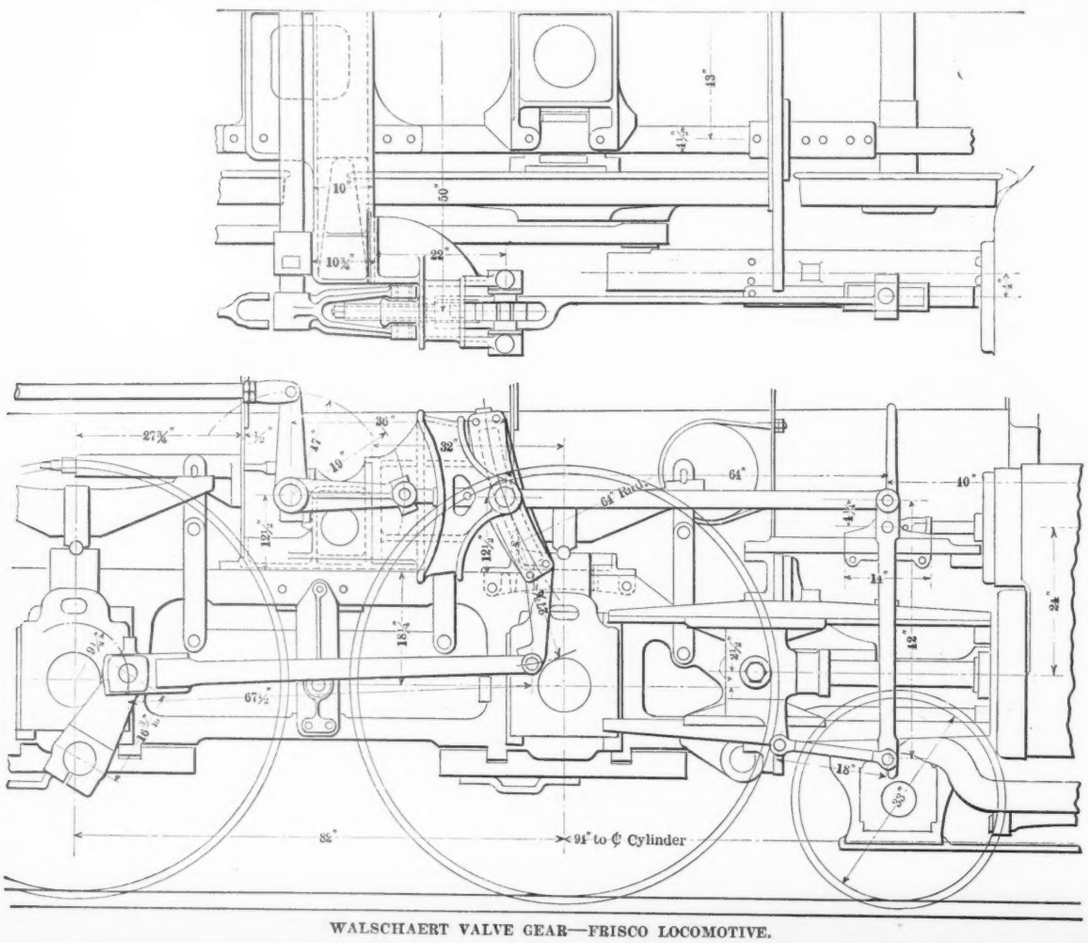
TEN WHEEL LOCOMOTIVE WITH WALSCHAERT VALVE GEAR.

ST. LOUIS & SAN FRANCISCO RAILROAD.

The American Locomotive Company has recently delivered from its Schenectady works an order of ten 10-wheel locomotives for the St. Louis and San Francisco Railroad to which an interesting application of the Walschaert valve gear has been made. This order follows a previous one of five engines of exactly the same dimensions which were equipped with the Stephenson valve gear. Since this last order has been delivered another small order to the same specifications has been made.

These locomotives are for heavy passenger and fast freight service on divisions where there are numerous grades from one to one and a half per cent., and the service to date is reported as being very satisfactory in every way. The general construction of the locomotive outside of the valve gear, while showing careful attention to details and to obtaining the best possible design of boiler for the type, offers nothing particularly unusual. The driving wheel base has been lengthened to 15 ft. 10 ins., which places the 69 in. wheels a considerable distance apart, allowing excellent opportunities for inspection.

The application of the Walschaert valve gear to a Pacific or 10-wheel locomotive presents difficulties not encountered on an Atlantic type, or any type having a two-wheeled engine truck. This is due to the location of the forward driving wheel, which is so far forward as to throw the guide yoke up to the centre of the guides, and not far enough forward to allow the yoke to be placed back of the first driver, and hence it is impossible to carry the link on a support from the guide yoke as is usually done. On the other hand, it is not advisable to locate the link at a point back of the front driving wheel, as this gives an excessively long radius bar and a short eccentric rod, hence the desirable location for the link places



WALSCHAERT VALVE GEAR—FRISCO LOCOMOTIVE.

it at a point somewhere near the centre of the front driving wheel.

The difficulty has been solved on this locomotive by the use of a cast steel cross tie on top of the frames, to which is secured a special shaped casting extending forward and outside of the driving wheel from which the link is supported. This cross casting also carries the bearing for the reverse shaft, the arm connection to the radius bar being made by a slip joint. The result by this arrangement is an almost ideal valve motion.

The construction of the valve gear is shown in the illustration herewith and the general dimensions, weights and ratios of the locomotive are as follows:

GENERAL DATA.

Gauge	4 ft. 8½ in.
Service	Mixed
Fuel	Bituminous coal
Tractive effort	28,300 lbs.
Weight in working order	183,000 lbs.
Weight on drivers	136,000 lbs.
Weight on leading truck	47,000 lbs.
Weight of engine and tender in working order	310,800 lbs.
Wheel base, driving	15 ft. 10 in.
Wheel base, total	26 ft. 10 in.
Wheel base, engine and tender	55 ft. ¾ in.

RATIOS.

Weight on drivers ÷ tractive effort	4.7
Total weight ÷ tractive effort	6.45
Tractive effort x diam. drivers ÷ heating surface	7.5
Total heating surface ÷ grate area	55.8
Firebox heating surface ÷ total heating surface, per cent	6.2
Weight on drivers ÷ total heating surface	51.1
Total weight ÷ total heating surface	69
Volume both cylinders	10.4 cu. ft.
Total heating surface ÷ vol. cylinders	255
Grate area ÷ vol. cylinders	4.58

CYLINDERS.

Kind	Simple
Diameter and stroke	21 x 26

VALVES.

Kind	Piston
Diameter	12 in.
Greatest travel	5¾ in.
Outside lap	1 1/16 in.
Inside clearance	0 in.
Lead, constant	¼ in.

WHEELS.

Driving, diameter over tires	69 in.
Driving, thickness of tires	3½ in.
Driving journals, main, diameter and length	9 x 12 in.
Driving journals, others, diameter and length	9 x 12 in.
Engine truck wheels, diameter	33 in.
Engine truck, journals	6 x 11 in.

BOILER.

Style	E. W. T.
Working pressure	200 lbs.
Outside diameter of first ring	66¾ in.
Firebox, length and width	102⅛ x 67¼ in.
Firebox plates, thickness	⅜ and ½ in.
Firebox, water space	F. 4½, S. and B. 4 in.
Tubes, number and outside diameter	318—2 in.
Tubes, length	15 ft. ½ in.
Heating surface, tubes	2,489.7 sq. ft.
Heating surface, firebox	164.6 sq. ft.
Heating surface, total	2,654.3 sq. ft.
Grate area	47.69 sq. ft.
Smokestack, diameter	15 and 17¾ in.
Smokestack height above rail	15 ft. 7 11/16 in.
Centre of boiler above rail	115 in.

TENDER.

Tank	Water bottom
Frame	10-in. chan.
Wheels, diameter	33 in.
Journals, diameter and length	5½ x 10 in.
Water capacity	6,000 gals.
Coal capacity	10 tons

REINFORCED CONCRETE.—The observed facts impel the lay reader to one definite conclusion: That reinforced concrete is a dangerous building material, dangerous for unknown reasons, among which may be these: either (1) because safe methods of design have not yet been developed, or (2) because the commercially obtainable materials of construction are subject to unknown variations which may produce fatal weakness, or (3) because the quality of labor employed is not high enough to insure the safe construction of the design, even though design and materials be satisfactory. To this conclusion we are regretfully forced to subscribe. We make but one reservation—namely, that if an independent engineer be employed to either work out the design, or to prescribe specifications and verify the design by them; and if further an independent engineer be placed in charge of the construction work to see that it is properly done, then reinforced concrete construction is as safe as other types of construction. Under all other circumstances we believe it involves so much risk that it must be characterized as dangerous.—*Engineering News.*

WATER TUBE LOCOMOTIVE BOILER.

In October, 1905, pp. 376, we illustrated and briefly described the Roberts water tube locomotive boiler which had been put into service on the Paris-Lyons-Mediterranean Railway. The following account of a later design of the same arrangement and of the service of the first one is taken from Engineering (London):

The ordinary type of locomotives never gave complete satisfaction on the Algerian lines of the P. L. M. Ry. owing to the inferior quality of the feed-water; the firebox stays broke frequently, cracks developed in the firebox tube-plates, and matters became worse as engines of increased boiler pressure and higher power were put in service to cope with increased traffic; these had to be thoroughly overhauled after they had run only about 20,000 miles. The outside appearance of the Roberts boiler is the same as that of an ordinary locomotive boiler, but is of larger proportions.

The first boiler of this type was fitted to a freight locomotive which was transformed at the Algiers shops into a Bissell two-wheel truck engine. This engine was placed in service at the end of February, 1904, and up to February, 1906, it had run over 80,000 miles. At first, when the engine commenced dealing with the traffic, the evaporation of the boiler was highly satisfactory, but gradually decreased, owing to the deposit of scot and ashes round the tubes; this deposit had to be removed every time the locomotive entered the shed. To prevent this trouble, the boiler has been fitted with a tube-cleaning device, which consists of two thick tubes placed one above the other, parallel with the centre line of the boiler, and made with holes ⅛ in. in diameter, cut slanting. Steam jets through these holes clear away the deposit, the soot and dust escaping through the chimney under the action of the blower. By this means the high degree of evaporation is maintained, and the locomotive, it is claimed, is capable of hauling 25 per cent. more than those of ordinary type with equal grate area and heating surface.

Both the firebox and the drum-tubes of the first boiler were made of copper, with a view to minimize the danger of corrosion. But all the firebox tubes and the first row of drum-tubes began to show signs of failure, and had to be replaced by steel tubes, the former, after the locomotive had run a total of under 10,000 miles, and the latter, after about 22,000 miles. The steel tubes stand perfectly.

It had been hoped that the rapid circulation inside the tubes would prevent the formation of sediments, and such is the case at first; but sediment gradually forms in service, and is removed by cylindrical brush-cleaners for the tubes at the smokebox end, and by hammering for the furnace-tubes and the first sets of drum-tubes. Scrapers fitted to a flexible shaft driven by the power available at the locomotive shed, are also used for removing the scale from the tubes.

The boiler exhibited at Milan differs from the first one by slight modifications in the arrangement of the water return-tubes, and by the addition of doors to the sides of the tube sets for cleaning by hand, by a steam jet, or by brushes. The large return tubes which in the first boiler connected the feed-collecting tube at the bottom of the firebox to the two drums have been done away with, as it was found that the joints were difficult to maintain tight. They are replaced by large diameter steel tubes in the front and rear of the firebox, and covered by a fire-brick lining. The feed-collecting tube at the bottom of the firebox is made of circular bent plates riveted together; this has allowed the fitting of return tubes of large section. The steam and exhaust pipes are arranged in the usual way in the smokebox, access through the latter not being now needed for cleaning the tubes. The steam dome is near the smokebox end, and the manhole is provided in the rear end of the steam drum, the manhole cover being above the foot-plate, and independent of the safety-valves; an arrangement which facilitates the inspection of the steam drum.

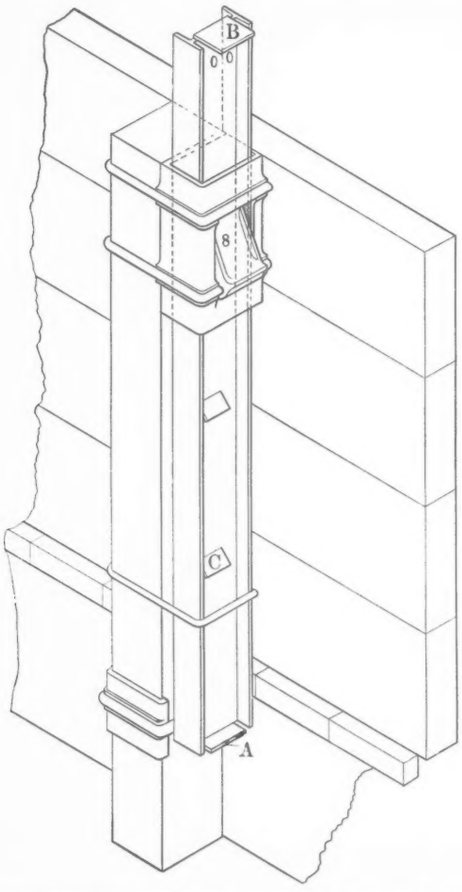
The Canadian laws make an engineer or conductor who is intoxicated while on duty liable to imprisonment for ten years.

EXTENSION STAKES FOR GONDOLA AND FLAT CARS.

The expense of the temporary stakes, braces and ties for loading lumber or similar material on flat or gondola cars, in accordance with the M. C. B. rules for loading long material, amounts, on an average, to about $5.00 per car. These temporary fixtures are usually destroyed or lost in unloading the car. The lumbermen's associations in various parts of the country have protested against being called upon to furnish this temporary equipment and have suggested that the railroads arrange such of their cars as may be used for the transportation of this class of lading with permanent stakes.

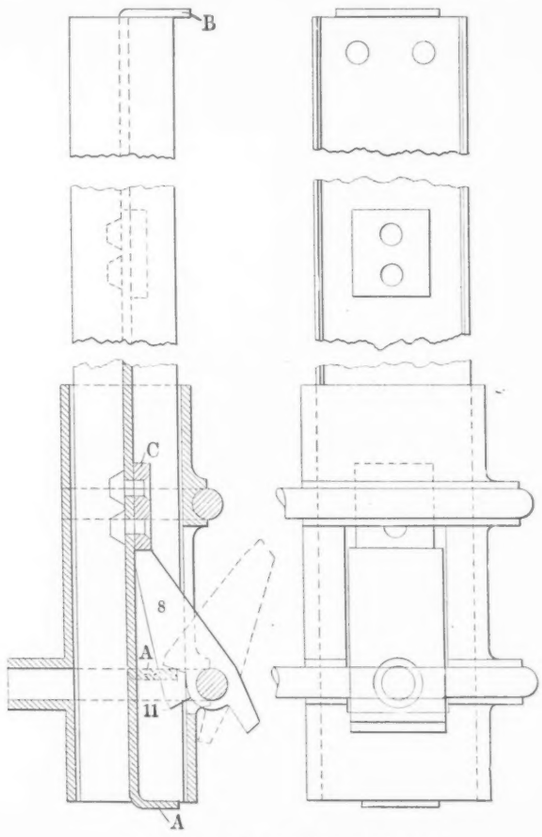
At a hearing before the Interstate Commerce Commission last September the general counsel for the lumbermen's associations stated that many of the cars on roads in the lumber district were temporarily equipped from 10 to 50 times a year and that very little of this temporary equipment was used a second time. It was estimated that over 300,000,000 feet of lumber were consumed annually in fitting the cars with these temporary stakes and braces. The aggregate cost of temporarily equipping flat and gondola cars in this service amounts to between eight and ten million dollars a year. Some individual shippers expend as much as $50,000 per year for this purpose. It was estimated that all of the flat cars in this country, something less than 150,000 in number, and an equal number of gondola cars, could be equipped with permanent stakes for less than the lumbermen pay each year for temporary stakes. It was also estimated that the annual revenue for transporting lumber and forest products in the United States amounted to $544,000,000, which is more than 20 per cent. of the annual gross earnings of the railroads.

The western railways and lumbermen have appointed committees to investigate the practicability of equipping the cars with permanent stakes, and the eastern roads have also undertaken a similar investigation. It is expected that the matter will be brought before the next Master Car Builders' convention and that some definite action will be taken in the near future.



APPLICATION OF EXTENSION STAKE TO GONDOLA CAR.

Mr. W. O. Moody, mechanical engineer, and Mr. H. A. Simms, general car inspector, of the Illinois Central Railroad have recently patented a telescopic stake for use on cars hauling material of this kind which has several important advantages. The construction of the stake and its application to a gondola car are clearly shown on the accompanying illustrations. It must, of course, be understood that the lug C on the general drawing is of the same construction as the one shown in the detail drawing. The sectional view shows the position of the stake when it is extended. The pawl (8) engages with the lower edge of the block C, which is riveted to the web of the I beam stake. By throwing the pawl to the position shown by the dotted lines the stake may be lowered. The lip B at the top of the stake projects sufficiently so that it will engage with the stake pocket and not allow the stake to drop through to the ground. The projection or lip A at the bottom of the stake prevents it from being withdrawn at the top as the lip will engage with the lug (11) on the pawl. To withdraw the stake it is necessary to remove the pawl, which can only be done by removing the lower U bolt on which it fulcrums. The construction of the pawl is such that the stake can easily be raised to its extended position. The two holes at the top of the stake are for the purpose of tying across the car by means of a wire or chain. The construction and operation of this stake are very simple, and it has the advantage of being self-contained with no loose or removable parts.



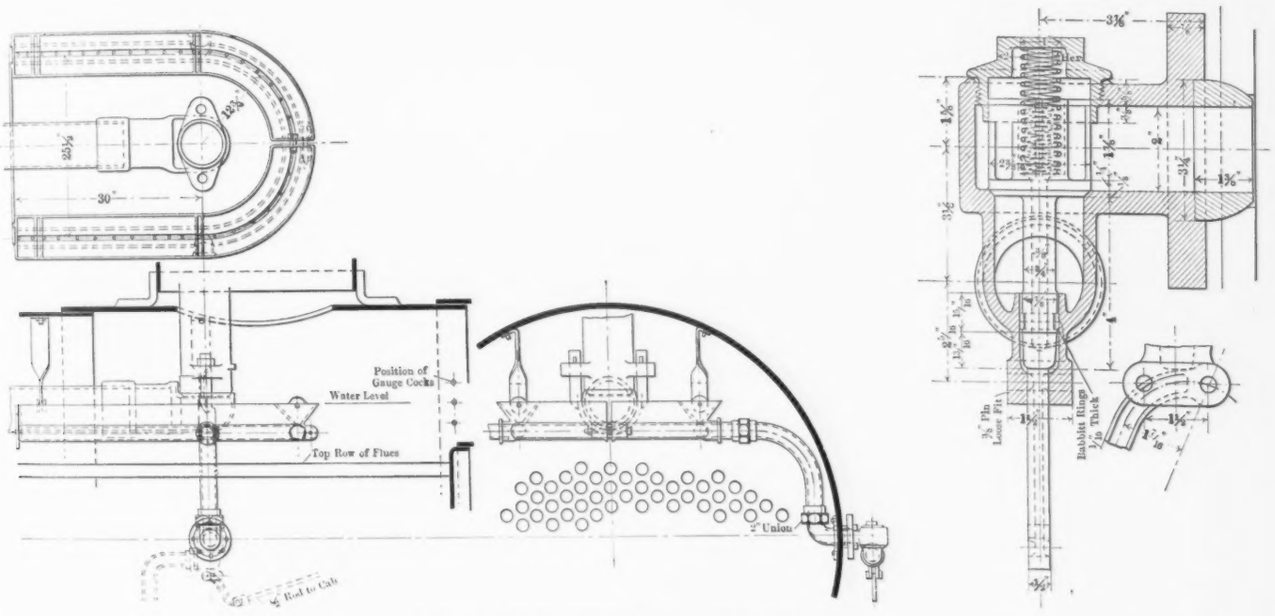
SIMMS-MOODY EXTENSION STAKE.

THE FUTURE LEADERS.—The great railroad man of to-morrow will be he who operates most economically, just as yesterday it was the traffic man who secured the most business, and to-day is the financial man who consolidates and juggles values. This signifies the ultimate ascendancy of the mechanical department, just as the tradesman has supplanted the feudal baron, and is in turn being superseded by the scientific methods of the engineer.—*Paul R. Brooks, before the New York Railroad Club.*

LOCOMOTIVE SKIMMER AND BLOW-OFF VALVE.

The undesirable, to say nothing of the disastrous results of a locomotive carrying a large amount of water over into the cylinders are too well recognized to need elaboration. There are many districts throughout the country where the boiler waters in use contain impurities of a nature to cause foaming, but because of the small amount of hard scale-forming impurities, and the recurrence of the difficulty only at certain periods of the year, making it undesirable to treat the water in a purifying plant or otherwise, dependence is placed altogether upon frequent blowing down of the boiler and numerous washouts to overcome the trouble.

It is specially for such conditions that the skimmer and its connections, which are illustrated herewith, have been designed by Mr. J. B. Barnes, superintendent of the locomotive and car departments of the Wabash Railroad and successfully applied and used by him for several years. Mr. Barnes informs us that a 21 x 26 in. Atlantic type locomotive, which before being fitted with this device required a washout at the end of every 1,000 mile run, was easily able after the application of the skimmer to make a mileage of over 8,000 miles between washouts, resulting not only in a saving due to the cost of washing out and the water lost, but also to a much greater saving in connection with keeping the locomotive in service, this saving being estimated at 50 hours saved between every washout when equipped with the skimmer.



BARNES BOILER SKIMMER AND BLOW-OFF VALVE.

The construction and application of the device is clearly evident in the illustrations, and it will be seen that it consists of a short U-shaped trough which includes in the same casting a 2 in. pipe below the trough with 5-16 in. cored holes between. This trough is located just above the average water level around the throttle pipe and has a connection on either side through 2 in. wrought iron pipes to specially designed blow-off valves located outside of the boiler shell.

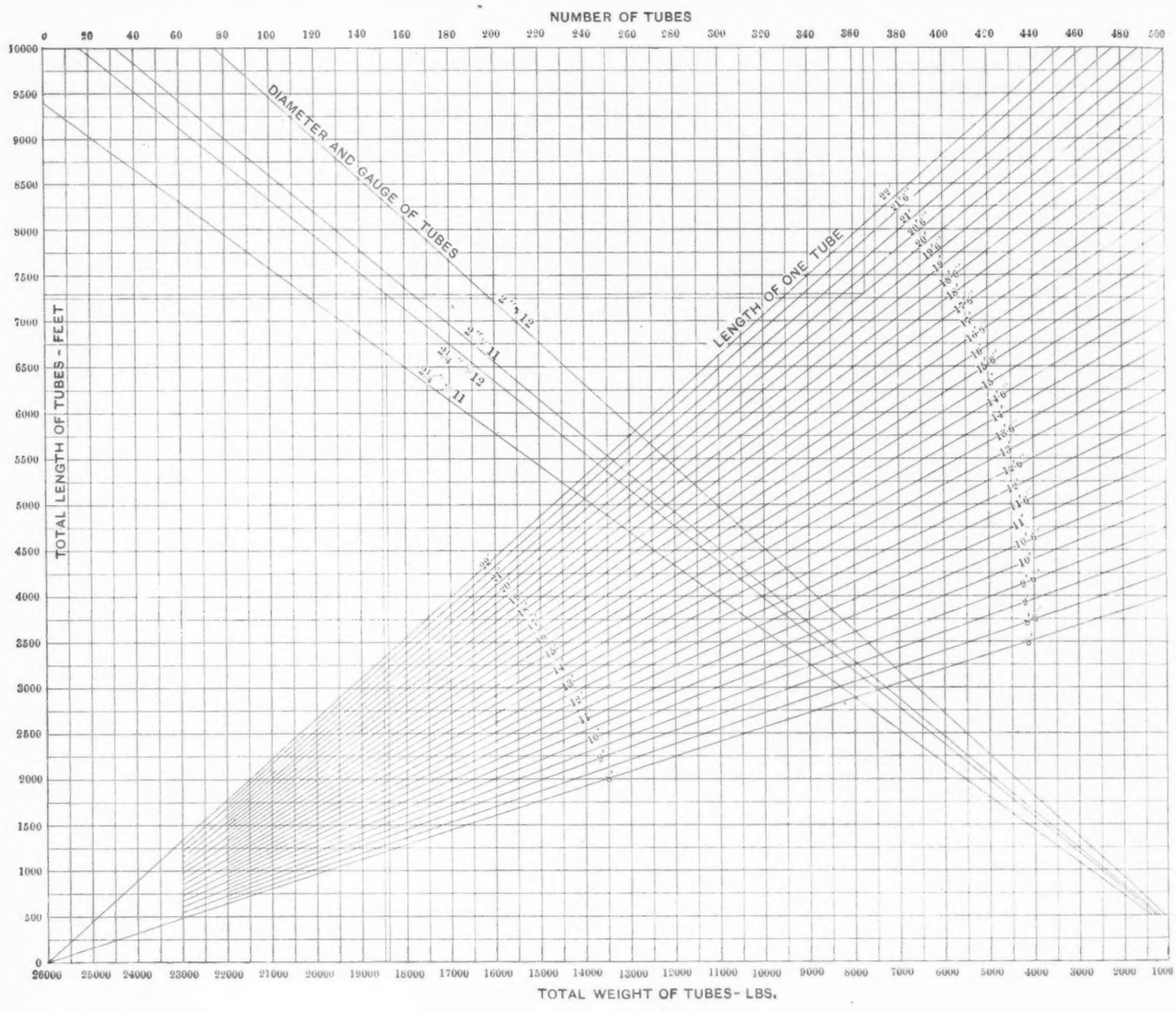
The blow-off valve, which is also illustrated, is made completely of brass with the exception of the spring, which is of German silver wire, and the lever, which is malleable iron or cast steel. The valve and its stem are cast intregal, the part above the seat having four wings, which fit into a projection of the nut, forming a guide for the upper part and the stem proper passing through the valve body, forming a lower guide, which insures the square and proper seating of the valve. It is operated by a lever from the cab and the spring insures positive seating when the lever is released.

Of course when the locomotive is working steam and starts to foam there is a rush of water upward around the throttle pipe, and on such occasions the opening of the blow-off valve forms a counter circulation which draws the water away from the throttle and prevents it being carried over into the cylinders. From experiments made up to this time it appears that at the same time the impurities causing the foaming, which naturally arise to the top of the water, are carried away by this skimmer, a fairly large part of the scale-forming impurities are also blown off, and the boilers so fitted do not appear to be as badly scaled as other boilers using the same water which are washed out eight times as often.

Both the skimmer and valve have been patented by Mr. J. B. Barnes.

SHOP LIGHTING.—A feature of incandescent electric lighting in shops and factories that has been greatly neglected is the provision for proper connections from the wire mains to the lamps used on the machines. The common practice has been to carry a double flexible cord from the nearest lamp socket to a portable lamp hung on some rickety fixture attached to the machine. That this practice is not only slovenly but actually dangerous besides has been shown frequently by the experience of unfortunate operators, who have been badly burned or shocked by short circuits. Not only this, but the use of lamp cord in such a manner is wasteful. It lies around on the floor, where the insulation is bruised and soon destroyed, and the amount of cord that may be needlessly used up in a large shop in the course of a year is a considerable item. Where the proper attention is given to this feature of machine shop equipment, the machines are wired the same as a building, the wires being carried up inside the columns of the machines in insulated cables. Sockets are provided at various convenient points, in which a plug, connected to a short length of flexible cord, can be inserted. The nearest socket will then be used to suit the convenience of the work. With machines wired in this manner, the length of flexible cord required is short.—*Iron Age.*

MANUFACTURING METHODS IN RAILROAD WORK.—In the large shops, however, where heavy rebuilding and new work is carried on together with finished material for shipment to outside points, and the work is not interrupted by roundhouse demands, manufacturing methods can and should prevail, and here the engineer is in his element, in fact, his knowledge is essential to its success.—*Mr. W. E. Symons at Purdue University.*



LENGTH AND WEIGHT OF BOILER TUBES.

LOCOMOTIVE BOILER TUBES.

HEATING SURFACE.—Table No. 1 affords a convenient means of quickly finding the total heating surface of the tubes in a boiler. The heating surface in square feet is given for tubes from 7 to 26 ft. in length and from 1½ to 2½ ins. in diameter, also the same information for each inch up to a foot in length and for fractions of an inch varying by sixteenths. In using the table, add together the heating surface for the feet, inches and fraction of an inch for one tube and multiply by the number of tubes. This table is similar to one arranged by Mr. Francis J. Cole, which appeared in our September, 1899, journal, page 292, except that additions have been made to cover the longer tubes which have come into use since that time.

FIRE AREA.—The total fire area of the tubes in a boiler may quickly be found by means of table No. 2. This shows the fire area for from 1 to 10 tubes of various gauges and from 1¾ to 2½ ins. in diameter. As an example, to find the fire area of 548 2-in. tubes, No. 12 gauge: Under 2-in. tubes, No 12 gauge, find the area for 5 tubes and move the decimal point two places to the right (1245); add to this the area for four tubes with the decimal point moved one place to the right (99.6), and the area for eight tubes (19.9), which gives a total of 1,364.5 sq. ft.

LENGTH AND WEIGHT OF TUBES.—The accompanying chart affords a quick and convenient means of estimating the length and weight of the tubes in a boiler. The item of the weight of tubes becomes an important one in the design of locomotives where the weights have to be held strictly within given limits, and it is sometimes necessary to change the gauge in the thickness of the tubes to enable the designer to keep within the weight limit and still retain the desired total heating surface. Starting at the top of the diagram with the given number of tubes, follow the line vertically until it intersects the diagonal of the given length of the tubes (for calculating weights or aggregate lengths, this length should be taken as one inch more than the normal length to allow for beading), follow the horizontal line at this intersection until it intersects the diagonal of the given diameter and gauge and thence to the bottom of the chart, where the total weight may be read. To obtain the aggregate length of the flues, follow the horizontal from the intersection of the vertical for the number

FIRE AREA OF TUBES.

Diameter in inches.	1¾			2			2¼		
Gauge	13	12	11	13	12	11	13	12	11
Area 1 tube.....	1.917	1.84	1.767	2.58	2.49	2.405	3.341	3.24	3.142
Area 2 tube.....	3.834	3.68	3.534	5.16	4.98	4.810	6.682	6.48	6.283
Area 3 tube.....	5.751	5.52	5.301	7.74	7.47	7.215	10.023	9.72	9.425
Area 4 tube.....	7.668	7.36	7.068	10.32	9.96	9.620	13.364	12.96	12.566
Area 5 tube.....	9.585	9.20	8.835	12.90	12.45	12.025	16.705	16.20	15.708
Area 6 tube.....	11.502	11.04	10.602	15.48	14.94	14.430	20.046	19.44	18.849
Area 7 tube.....	13.419	12.88	12.369	18.06	17.43	16.835	23.387	22.68	21.991
Area 8 tube.....	15.336	14.72	13.136	20.64	19.92	19.240	26.728	25.92	25.133
Area 9 tube.....	17.253	16.56	15.903	23.22	22.41	21.645	30.069	29.16	28.274

HEATING SURFACE OF FLUES IN SQUARE FEET

Outside diameter of flues.	Circumference in inches.	FEET.																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1½	4.7124	.033	.065	.097	.131	.164	.196	.229	.260	.294	.327	.360	.392	5.101	5.494	5.886	6.278	6.671	7.062	7.455	7.848	8.240	8.633	9.025	9.418	9.810	10.202
1¾	5.4978	.038	.076	.114	.152	.191	.229	.267	.305	.342	.382	.418	.458	5.956	6.415	6.873	7.331	7.789	8.247	8.706	9.164	9.622	10.080	10.538	10.997	11.455	11.913
2	6.2832	.044	.087	.131	.174	.218	.262	.305	.349	.392	.436	.479	.528	6.807	7.330	7.854	8.377	8.901	9.425	9.948	10.472	10.995	11.519	12.043	12.566	13.090	13.613
2¼	7.0686	.049	.098	.147	.196	.245	.294	.343	.393	.442	.491	.539	.589	7.653	8.242	8.830	9.419	10.008	10.596	11.185	11.774	12.363	12.951	13.540	14.129	14.717	15.306
2½	7.8540	.054	.119	.163	.218	.272	.327	.381	.436	.490	.540	.599	.654	8.508	9.163	9.817	10.472	11.126	11.781	12.435	13.090	13.744	14.399	15.053	15.708	16.362	17.017

Outside diameter of flues.	FRACTIONS OF AN INCH.																									
	1-16	⅛	3-16	¼	5-16	⅜	7-16	½	9-16	⅝	11-16	¾	13-16	⅞	15-16
1½	.002	.004	.006	.008	.010	.012	.014	.016	.018	.020	.022	.024	.026	.028	.031
1¾	.002	.005	.007	.009	.012	.014	.017	.019	.021	.024	.026	.028	.031	.033	.036
2	.003	.005	.008	.011	.013	.016	.019	.022	.024	.027	.030	.033	.035	.038	.041
2¼	.003	.006	.009	.012	.015	.018	.021	.024	.028	.031	.034	.037	.040	.043	.046
2½	.003	.007	.010	.014	.017	.020	.024	.027	.031	.034	.037	.041	.044	.048	.051

of tubes and the diagonal for the length of the tubes to the left side of the diagram. Lines on the chart show the method of finding the length and weight of 365 tubes 20 ft. long, 2¼ ins., outside diameter. The total length is about 7,300 ft. and they weigh about 18,400 lbs. These weights are based on the nominal weights of the tubes plus 2½ per cent. to allow for overweight. This gives the following weights per foot: 2.22 lbs. for 2 in. No. 12; 2.44 lbs. for 2 in. No. 11; 2.52 for 2¼ in. No. 12; 2.77 lbs. for 2¼ in. No. 11. This chart is similar to one presented by Mr. F. K. Caswell in our February, 1901, journal, page 64, except that it has been adapted for the longer tubes which have come into use since that time.

EXHIBITS AT THE ATLANTIC CITY CONVENTIONS.

The secretary of the Railway Supply Men has issued a circular to the members giving information concerning the plans for the exhibition to be held on the Steel Pier in connection with the Master Mechanic's and Master Car Builders' conventions, June 12-19, 1907. It is planned to depart from the usual custom at this exhibition by accepting an offer from the Atlantic City Hotel Men's Association to erect all booths and exhibit structures. This association has engaged the services of an architect and plans have been prepared for the purpose of obtaining booths which will be uniform in appearance and decoration, and make the best possible use of the space available on the Steel Pier. The circular is accompanied by a reproduction from a water color showing the appearance of the pier with the exhibit spaces as planned.

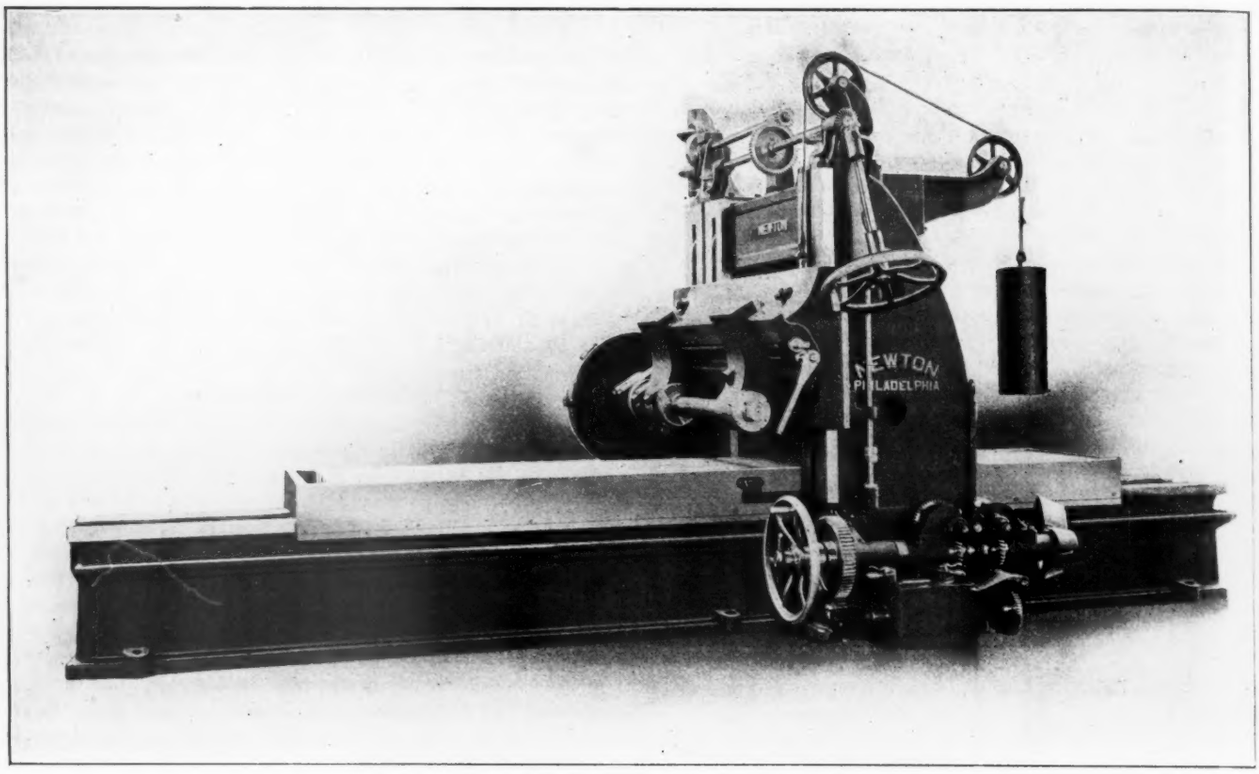
If the present plans are carried out the general appearance of the exhibition will be much improved over that of previous years and the expense to the exhibitors for better facilities than usual will be decreased. The booths will be the property of the Atlantic City Hotel Men's Association and will be available for use in succeeding years at a lower price than is to be charged for this year. The same association agrees to furnish all furniture, such as desks, tables, chairs, etc., at a standard price, which is given in the circular. The booths will be rented at a cost of 50 cents a sq. ft. and will be ready for use on June 1. It is specified that all exhibits must be completed by Tuesday evening, June 11th, and must be removed prior to June 26. It is arranged to furnish steam, at 100 lbs. pressure, free of charge, the exhibitor paying for his own connections. Electric current for both power and lighting will be available and compressed air will be provided in the customary way, the consumer making his own arrangements with the exhibitors who have compressors in operation.

It is requested that all those expecting to make exhibits will inform the secretary, Mr. Bruce V. Crandall, 510 Security Building, Chicago, Ill., as soon as possible. At the issuing of this circular application had been made for fully 35 per cent. of the available space but none had then been assigned.

REINFORCED CONCRETE.—Concerning the value of reinforced concrete for factory buildings, I would say that there is no question as to its manifest advantages in incombustibility, rigidity, and permanence. There are, however, some disadvantages in its use which must be taken into consideration in recommending this material. These are the treatment of outside walls to insure freedom from cracks and a pleasing appearance; the size of interior columns where there are a number of stories to be supported; and the increased weight upon the foundations where the ground is soft. It is probable that as time goes on, we shall learn more with regard to methods of overcoming the above mentioned disadvantages, but now there is plenty of chance for study along this line.—*Mr. J. R. Worcester in Cement Age.*

INVITE CRITICISM.—Reach far and grasp everything in sight and struggle for more; invite criticism and do not either shrink from or fail to defend the title of crank; but, first be absolutely sure you are right, that your position is based on sound engineering principles, both in theory and practice Criticism that is known to be the forerunner of unqualified endorsements are blessings in disguise, and music to the ears of those they are directed against.—*Mr. W. E. Symons at Purdue University.*

ADDRESSES AT PURDUE UNIVERSITY.—On January 21 Mr. Wilson E. Symons, president of the Pioneer Cast Steel Truck Company, Chicago, addressed the engineering assembly of Purdue University on the subject of "Theory vs. Practice in the Work of the Mechanical Engineer." On January 28 the same assembly was addressed by Mr. Harrington Emerson, expert production engineer, who took as his subject "Railroad Operating Records."

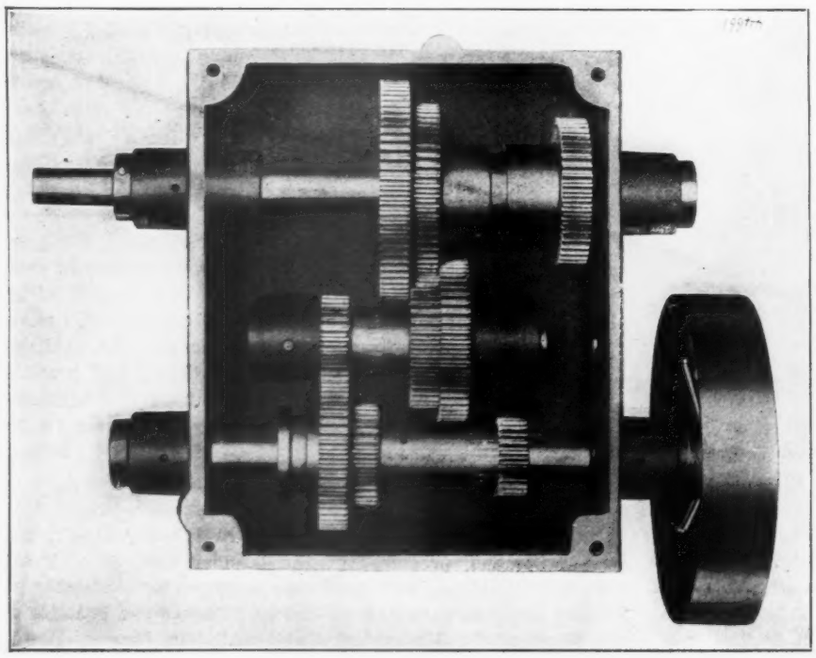


WORKING SIDE OF HEAVY NEWTON SLAB MILLING MACHINE.

HIGH DUTY SLAB MILLING MACHINE.

Improved shop methods on our railroads have made it necessary to practically redesign many of the machine tools during the past few years. The more recent designs of slab milling machines have met with considerable favor and the range of work handled by them has been greatly extended. The older type machines were, as a rule, hardly stiff enough to use the ordinary steel cutters to advantage, but with the stronger and stiffer machines, used in connection with high speed steel cutters, it has been found economical in many instances to do work formerly done only on planers, and in some cases a considerable saving has been made by removing surplus metal by these machines rather than by forging closer to the finished sizes.

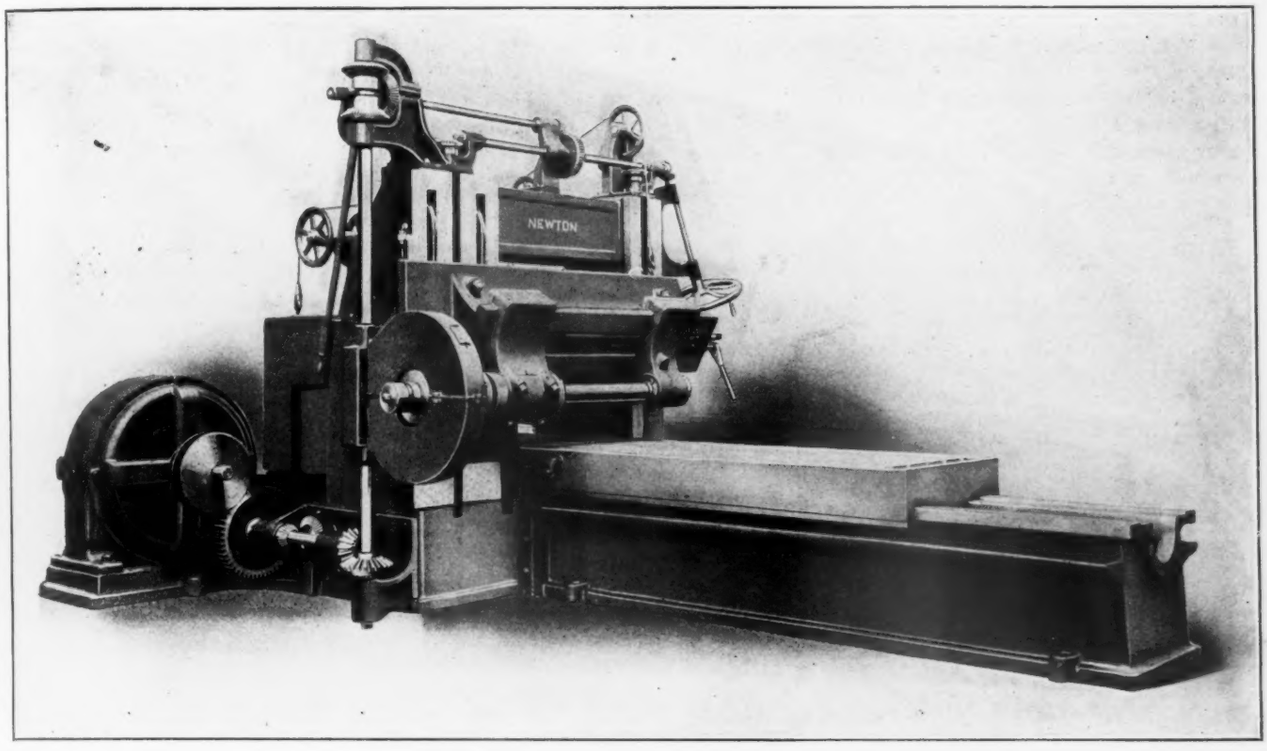
The illustrations show a heavy slab milling machine made by the Newton Machine Tool Works of Philadelphia, and especially adapted for railroad and locomotive shop usage. The spindle is 6½ ins. in diameter and has a main bearing 15 ins. long. It is driven by a phosphor bronze worm wheel and a case-hardened steel worm of steep lead, having a roller thrust bearing. This is driven by a 35 h.p., 2 to 1, variable speed motor through a train of gearing, as shown in one of the illustrations. The driving worm and worm wheel have a ratio of 20 to 1. All gears are of steel. The spindle is reduced to 6 ins. in diameter at the worm wheel bearing and is keyed to it by a double spline. The spindle has a side adjustment of 8 ins. for convenience in setting the cutters after the work has been placed on the machine. The arbor is arranged to drive by a "butterfly key" (a slot across the face of the spindle). The outboard bearing for the arbor is bushed, the bushing being tapered on the outside and split to compensate for wear, as it is arranged to fit over the arbor bushings and be adjusted to support the arbor close to the work.



VARIABLE SPEED GEAR BOX FOR TABLE FEED.

The cross-rail has an inclined face, which in addition to carrying the spindle close to the uprights, overcomes to a very great extent the tendency of the cutter to "pull in" when milling a piece which has a surface of widely varying widths. It also reduces the tendency to chatter to a minimum.

The cross-rail has a bearing 25 ins. wide and 38 ins. long on the main upright, and 12 ins. wide and 31 ins. long on the narrow upright. The face of the cross-rail is 16 ins. wide and the center of the spindle is 4 ins. below the face of the rail in order to work around forged oil



HEAVY NEWTON SLAB MILLING MACHINE SHOWING APPLICATION OF MOTOR.

cups on connecting rods, or to be able to sink in and mill keyways on large diameter shafts having widely varying diameters, or other similar work. The cross-rail is counterweighted and has hand adjustment and a power quick movement in both directions.

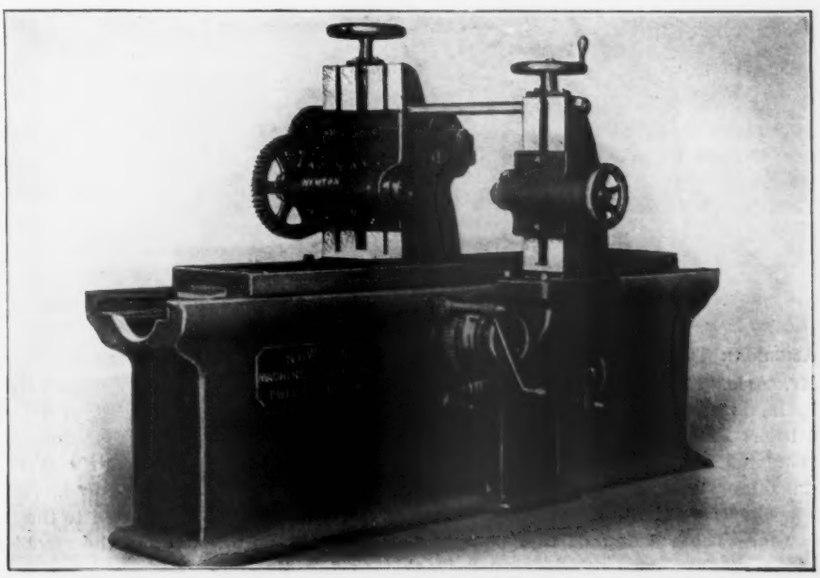
A special advantage and an important one for such work as fluting connecting rods, where it is necessary to sink the cutter from 1½ to 1¾ ins., is that the quick power movement is specially designed for this purpose. The cross-rail screws are arranged to pull the rail down into the work instead of pushing it, as is ordinarily done. This, in connection with provision which is made to prevent the table from pulling forward when sinking in, or working backward, due to the pulling of the cutter, overcomes the breaking of cutters and arbors and damage to the cross-rail.

The uprights are of extra heavy section and are 36 ins. deep. The carriage is 36 ins. wide and 7 ins. deep to mill 14 ft. in length. It has a bearing on the bed 29½ ins. wide and is operated by a steel rack 4 ins. wide and a bronze spiral pinion. Variation of the rate of travel or feed of the carriage is obtained by means of an easily controlled and compactly designed gear box, shown in one of the illustrations, for which a patent is pending. The gears in this box are all steel and run in oil. To distinguish the driving shaft a pulley has been placed on it. On this shaft are three gears on one sleeve which slide and mesh with the idle gears on the intermediate shaft, these in turn meshing with the sliding gears on the third shaft. The edges of the teeth are beveled in order that the gears may readily be changed from one position to another while running. The feed to the carriage of 1 to 10 ins. per minute is furnished with a quick power movement in both directions.

The following accounts of work, which are not record performances but have been done right along for a considerable time, show conclusively the advantages of the machine and the method of driving it. A cut 9½ ins. wide and 9/16 in. deep with a table feed of 8 ins. per minute was taken on a connecting rod. This is at the rate of 43 cu. ins. per minute or 1¼ cu. ins. per minute per rated horse power of the motor, which is said to exceed all previous records.

In another instance locomotive connecting rods have been fluted or channelled, two at a time, with cuts 3 ins. wide and 1½ ins. deep with a feed of 3¼ ins. per minute. The cutters used were of the inserted tooth type, with teeth of air hardened steel inserted on a true spiral. The cutters operated at a peripheral speed of 86 ft. per minute.

To give some idea of the advance in slab milling machine design, a machine made at the Newton Works in 1884 is illustrated. This machine was intended for the same class of

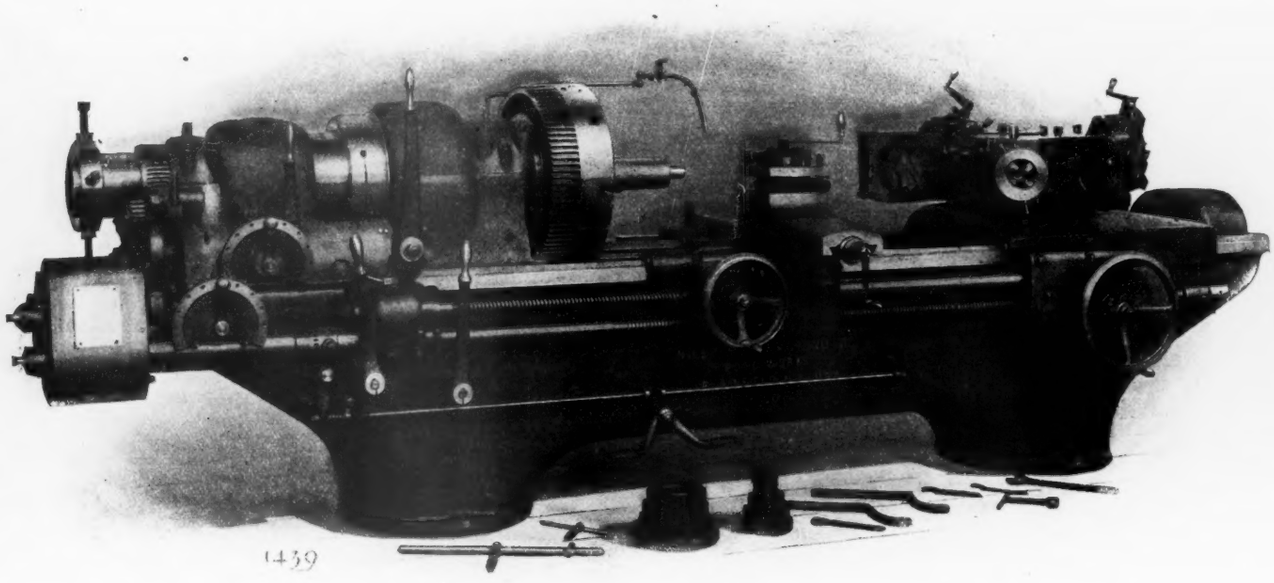


OLD TYPE NEWTON SLAB MILLING MACHINE—BUILT IN 1884.

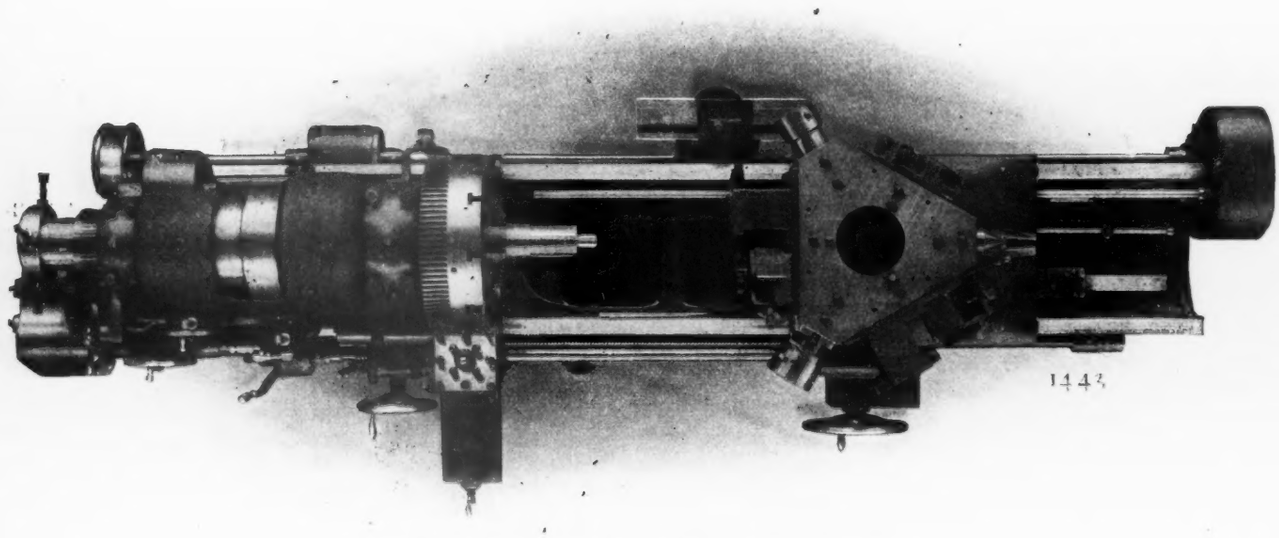
work as referred to above and is said to be the first commercially successful slab milling machine built. The table was of the inside square lock design in place of the overlapping square lock design in the later machines. The feed was controlled by a spur pinion and rack, quick power motion being obtained by the crank shown in the illustration, one turn of which advanced the carriage 7 ins. The spindle was driven by spur gears and the outboard bearing had to be adjusted independently of the main spindle bearing. In its day this machine was considered a record breaker.

POND "RIGID" TURRET LATHE EQUIPPED FOR BAR WORK.

The 28-inch Pond turret lathe, shown in the illustrations, was originally designed for chucking work only, but largely due to the demands of railroad shop work has been equipped for bar work. The view looking down on the top of the machine gives a good idea of the rigidity obtained by the use of short turning tools, the die head being placed directly on the turret face without the intervention of the usual die holder,



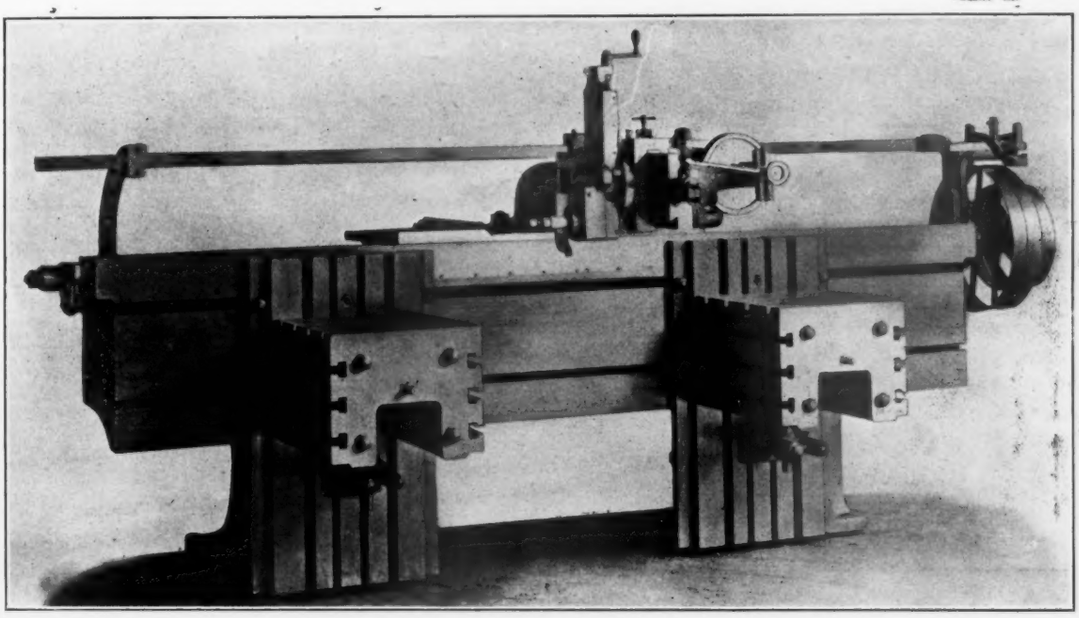
POND 28-INCH TURRET LATHE EQUIPPED FOR BAR WORK.



VIEW LOOKING DOWN ON TOP OF POND TURRET LATHE.

AMERICAN TRADING WITH THE LEVANT AND ITS POSSIBILITIES.—Mr. Aris. Tsakonas, M. E., 5212 Jefferson street, Philadelphia, is sending out to all American manufacturers who are interested, a pamphlet on the above subject. The excellent advice contained therein for the satisfactory marketing of machinery in the Levant has been drawn from a long personal experience in that section of the world as well as America. The reading of this pamphlet will be to the advantage of any firms considering a market in the Mediterranean district.

thus insuring perfect thread cutting within the limit of accuracy of the die head. Both the carriage and the turret are provided with six changes of feed, each being independent of the other and operated by different lead screws, so that, if desired, the work may be turned at the same time that it is being bored. When the cross carriage is not in use it may be moved to the left, as shown in the view looking down on the top of the machine. While in this position the turret may be brought close to the face of the chuck, making possible the use of short tools, which is a very desirable feature.



TRAVELING HEAD OPEN-SIDE PLANER—E. A. WALKER.

The turret is designed with very wide faces, making it possible to rigidly secure the heaviest tools. It rotates automatically and has a rapid power traverse in either direction. Independent stops are provided for each face, and it may be made to revolve at any desired point of its travel. The machine is designed for handling castings up to 28 ins. in diameter. The swing over the carriage arms is 26 ins. and over the cross slide 24½ ins. The lathe may be equipped with a 24-in. 3 or 4 jaw independent or combination chuck. The turret has a travel of 5 ft. The hole through the spindle is 4¼ ins. in diameter, and is counter-bored to 5 5/16 ins. for a distance of 12 ins. in order to permit boring bars with both roughing and finishing cutters to be used, the roughing cutter being inside the spindle, while the finishing cutter is at work. The compact and substantial design of this machine makes it especially advantageous for use in railroad shops.

STEEL PASSENGER CARS.—The operation of the steel passenger car shop did not contribute to the company's earnings, for the reason that education of men in a new line of industry is expensive and tedious, and full output of work cannot be secured by reason of the unfamiliarity of the workmen with the work; but we have gone far enough into this construction to know that, as a result of the operations to date, we can produce a first class fireproof passenger car with only a slight increase in weight over the present wooden type, but at an increased cost. The question as to how great will be the pecuniary benefit to accrue to the company from this department must be left to the future, as the railroads at the present time, when there is an urgent demand for better service, and the various State Legislatures are insisting on lower rates, naturally show hesitancy in doing anything that will increase the cost of their equipment. Our experience convinces us that until there has been a much larger volume of business presented, the cost cannot be substantially reduced. This company, by reason of its being a pioneer in the field, is necessarily in the front rank in this development, and so is prepared to furnish this fireproof passenger equipment whenever it can be sold at a reasonable profit.—*Report of Pres. Hoffstot of the Pressed Steel Car Co.*

RAILWAY STOREKEEPERS' ASSOCIATION.—The fourth annual meeting of this association will be held at the Auditorium Hotel, Chicago, Ill., May 20th, 21st and 22nd, 1907. The president is Mr. N. M. Rice, general storekeeper of the Santa Fe, and the secretary, Mr. J. P. Murphy, general storekeeper of the Lake Shore.

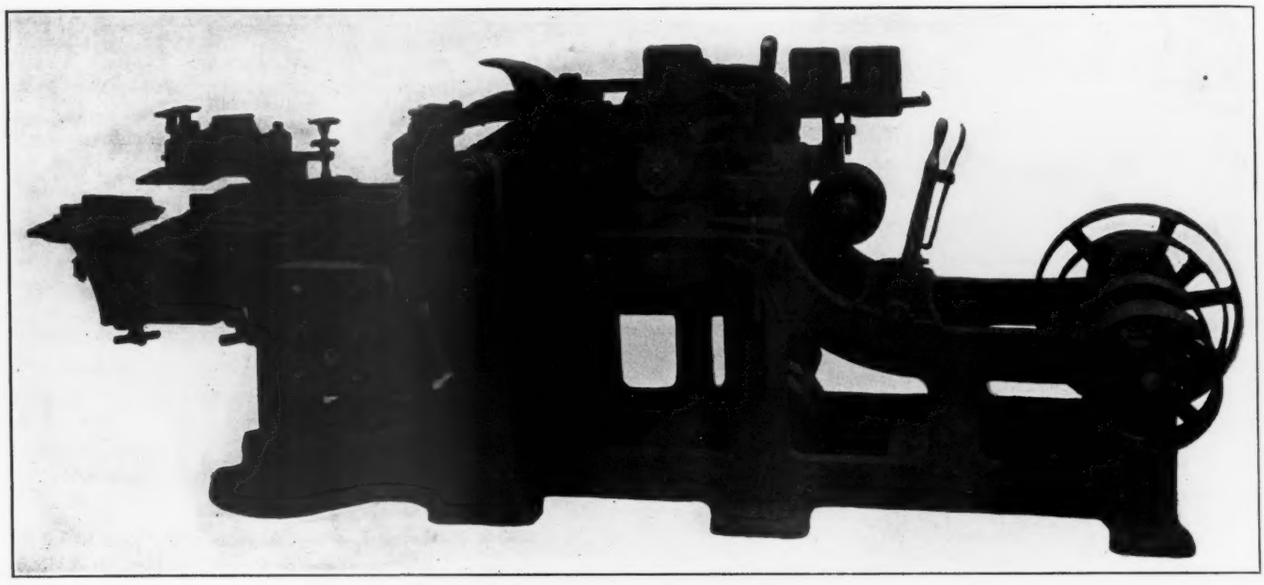
TRAVELINGHEAD OPEN-SIDE PLANER.

The traveling head open-side planer has many advantages for certain classes of work. The cutting tool travels instead of the work; the tool is carried by an overhanging arm; the traveling head is actuated by a screw; almost any piece of work, no matter how awkward, can be securely held in place by means of the slotted plates and the tables, and this is especially true if a pit is placed directly in front of the machine, thus making it possible to easily set in place and accurately plane with a minimum amount of power large and cumbersome pieces which it would be difficult to handle in a planer with its movable platen.

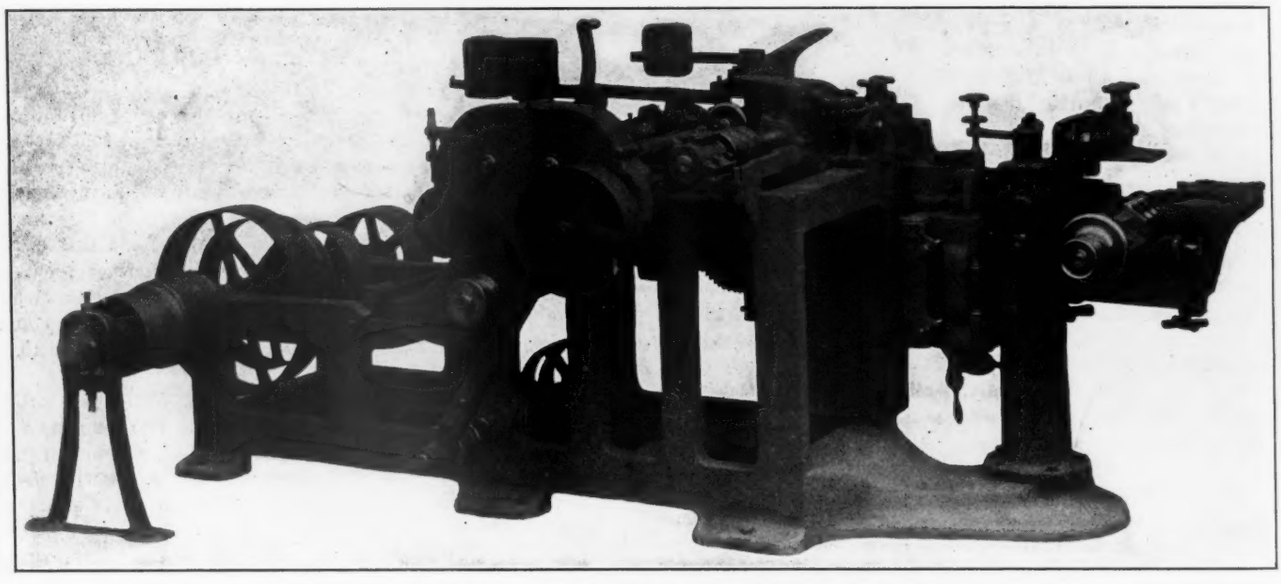
The machine illustrated is made by E. A. Walker, of Philadelphia, and is known as the Richards type. The table travels parallel to the bed, the tool carriage passing over such work as may be fastened to the slotted plates and tables. It will plane 8 ft. in length, has a cross feed of 25 ins., an angle or down feed of 12 ins., and weighs about 5 tons. The slotted plates are each 39 ins. long, 25 ins. wide and 3 ins. thick. The square tables are 15 x 19 x 22 ins. and have a vertical adjustment of 25 ins. A greater vertical adjustment may be arranged for by providing longer slotted plates. The distance from the floor to the underside of the crosshead is 42 ins.

Time may often be saved on certain classes of work by fastening one piece in place while another is being machined. If desired three tables may be provided, the third one often proving valuable, especially on the machines with larger beds. An idea of the wide range of work which may be handled to advantage on this type of machine is given in an illustrated booklet which may be obtained upon application to the manufacturer.

A SIMPLE DYNAMOMETER CAR can be constructed by strengthening the frame of an old passenger coach or even a caboose car, installing in it an hydraulic dynamometer, which can be purchased in the open market complete for about $250, and equipping the car with some form of speed indicator and recording machine that will be driven from the axle of the car and will have its paper travel so regulated that the draw-bar pull is plotted with relationship to the distance and speed. While many other features may be added to such a car, these are the essentials that are required for accurate work, and the whole arrangement, exclusive of value of the car used and the work done in strengthening the car, can be gotten up for $600 or $800.—*Mr. D. C. Buell, Central Railway Club.*



FRONT VIEW OF AMERICAN OUTSIDE MOULDER.



AMERICAN NEW 7 AND 8 INCH OUTSIDE MOULDER, REAR VIEW.

NEW AMERICAN OUTSIDE MOULDER.

On page 247 of our June, 1906, issue we described the new American four-colnmn outside moulder, arranged for working all four sides of a piece 12 or 14 ins. wide by 6 ins. thick. These moulders had several important improvements over previous designs. The new features have given such general satisfaction that the more important ones have been incorporated in the design of the standard machines. The illustrations show one of these improved machines which will work four sides, 7 or 8 ins. wide by 4 ins. thick.

The frame is cast in one piece, making it solid and substantial and preventing any twisting, thus keeping all bearings in perfect alignment. The heavy column at the rear end of the machine furnishes a substantial support for the table and the under head. An outside bearing is provided for the support of the top arbor, which extends to the floor and is firmly bolted to the base of the frame, while at the top it is secured by a heavy bolt passing through the table and the frame. It is adjustable for lining up the head. The bed is heavy and well porportioned and is securely gibbed to a frame, with provision for taking up wear. It raises and lowers 12 ins. by a large steel screw on ball bearings, operated by a crank. There is a detachable bed plate directly under the top cutter head, reversible, one side plain, the other side grooved ½ in. deep and ½ in. apart, to allow the cutters to project lower than the bed. The extension of the bed, beyond the lower cutter head, drops down, giving free access to the cutter head without disturbing the guides. The bed carries the inside and outside headstocks which have also an independent adjustment.

The feed rolls are 5 ins. in diameter and have an improved direct gear drive for top and bottom rolls, making a positive and very powerful feeding device and rendering the use of heavy weights unnecessary. Four rates of feed are provided to meet the requirements of the purchaser. The top head has a lateral adjustment. The bottom head has both lateral and vertical adjustments, which are controlled by a hand wheel. The side heads rise and fall with the table, and can be set to an angle and moved vertically and laterally without changing the angle. The outside side head is arranged with an adjustable weighted chip breaker which travels with the head. The inside head can be adjusted from either the front or the rear of the machine. Both side heads may be adjusted, while the machine is in motion. An adjustable tightener is provided for the belt driving the top head, by means of which

the slack may be instantly taken up, and permitting no greater strain than necessary when running on the lighter class of work.

The bars that carry the adjustable pressure shoes, over the under cutter and directly back of the top cutter head, are hinged and may be thrown back; each pressure shoe can be set at an angle, and each shoe has its own independent adjustment. The chip breaker and hood for the top head may be thrown up and back across the machine, giving free access to the top head. All cutter heads are provided with vertical and lateral adjustments and have a normal cutting circle of 5⅞ ins. All cutter head chip breakers are adjustable and will allow the knives to extend 2 ins., giving a maximum swing of 9⅞ ins. These moulders may, if desired, be arranged for driving by individual motors of 10 h.p. capacity. They are made by the American Woodworking Machinery Company.

FINISHED REPAIR PARTS FOR LOCOMOTIVES.

The importance of carrying finished material in stock at railroad repair shops, in order that an engine coming in for repairs may be turned out with as little loss of time as possible, is coming to be quite generally recognized. It has been found advisable to centralize the manufacture of repair parts at a central point on large systems from which the finished material, as far as possible, is sent to the various repair points. It is true, however, that even at the main shops the manufacturing work takes second place, the repairing of locomotives being considered as of first importance. It has been suggested that the work could be done more cheaply in a separate plant, entirely separated from the repair department, where highly specialized machinery was used, and that if such a plant was operated by outside parties working in competition with other concerns, the material could be furnished to the railroads more cheaply than they could make it themselves, especially if the methods of accounting on the railroad and in the manufacturing shop were placed on the same basis, or in other words, if the railroad company made a proper allowance for the general expenses or surcharges. The railroad officials, relieved of this part of the work, could then devote their efforts to other and more important work.

In this connection it is interesting to note that a company known as the Locomotive Finished Material Company, located at Atchison, Kans., has just completed a plant and is now making delivery of finished locomotive castings.

Castings for new work are finished complete to the drawings. Castings for repair work are finished to as great an extent as possible, leaving only the necessary stock for fits and wearing surfaces. As an illustration, cylinders are finished complete except the saddle; driving boxes are finished complete except for the hub faces and journal fit; shoes and wedges except for the driving box face; packing rings are finished complete; solid piston heads are finished, leaving sufficient stock for cylinder and rod fit; cylinder heads are finished complete; eccentric and eccentric straps are finished to standard dimensions or stock is left as specified.

As far as we know, this company is the first one which has been formed for the purpose of manufacturing finished locomotive castings, and it is understood that they already have several large orders. The president of the company, Mr. John Seaton, is also president of the Seaton Foundry Company of Atchison, which has furnished two of the large western railway systems with rough castings for the last thirty-five years. The general manager, Mr. H. E. Muchnic, has been connected with the mechanical department of one of the large railway systems and has a thorough knowledge as to railroad requirements and machine shop methods.

AUTOMATIC COCK GRINDER.

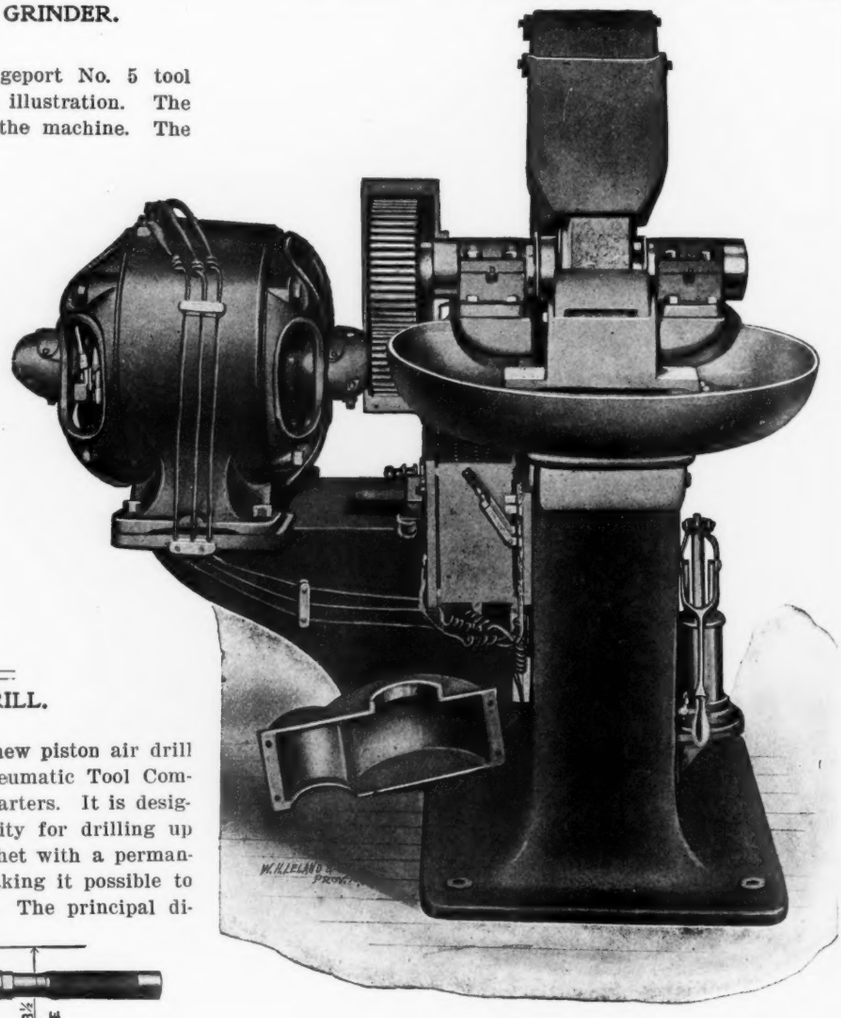
The automatic cock grinder shown in the il stration was designed to quickly and accurately grind in the plugs or keys for brass cocks. It is made in two sizes by the Turner Machine Company, 2049 North Second Street, Philadelphia. The larger size, or No. 2 machine, which is shown in the illustration, is adapted for cocks up to 3 ins. in size. It has eight spindles, requires two operators, and is said to be able to grind eight hundred ¾-in. cocks per day. At any time that it is desirable four of the spindles may be cut out of service and the machine may be operated by one man.

The No. 1 machine has four spindles, requires only one operator, will grind all sizes of cocks up to 2½ ins., and will grind as many as four hundred ¾-in. cocks per day. The barrel of the cock is held by an adjustable holder, the adjustment allowing an expansion vertically or laterally, in order to take the different sizes of cocks. The plug is held between centers, adjustment of the length of the spindles being made by a quick turn or thrust of the spindle, which is knurled at the operating end. Locking is effected by means of a lever stop at the side of the spindle. The head of the plug is held by dogs. The barrel of a cock may be held rigidly within its holder if desired, but generally a little play is allowable. The action of alternately forcing the plug into the barrel for grinding and withdrawing it is accomplished by cams and counterweights, the barrel being forced on by the counterweights and withdrawn by the cams. The spindles are operated by cut gears and a bronze cut rack, and make seven-eighths of a turn in each direction. Any spindle may be instantly thrown out by means of friction clutches operated by the levers seen above the bed plate. The connecting rod is of steel, fitted with brass boxes, the bearings for the driving shaft being babbitted. A pulley at the left of the driving shaft operates the cams. In action the machine is said to be noiseless.

AUTOMATIC COCK GRINDER.

BRIDGEPORT MOTOR DRIVEN GRINDER.

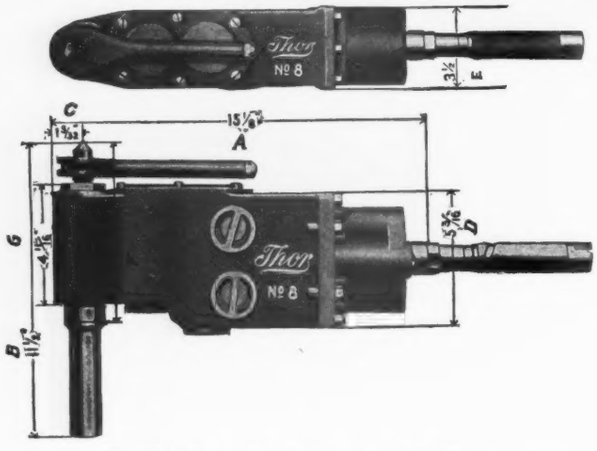
A typical motor application to a Bridgeport No. 5 tool grinder is shown on the accompanying illustration. The motor bracket is cast on the column of the machine. The motor, which may be of a make suitable to the purchaser, is back geared to the emery wheel spindle with a ratio of about 3 to 1. The gears are encased and the grinder spindle bearings are self-oiling. A 5-h.p. motor is used, and the emery wheel, 36 ins. in diameter with a 4-in. face, is operated at a speed of 425 r.p.m. The floor space occupied by the machine is 30 by 47 ins., and its weight complete is 2,650 lbs. The motor is controlled by a starting box, but ordinarily this is not used except at the beginning and end of the working day. These machines are made by the Bridgeport Safety Emery Wheel Company, Inc., Bridgeport, Conn.



MOTOR DRIVEN GRINDER.

CLOSE QUARTER AIR DRILL.

The accompanying illustration shows a new piston air drill recently perfected by the Independent Pneumatic Tool Company for work in corners or other close quarters. It is designated as "Thor" No. 8 and has a capacity for drilling up to a 2½ in. hole in any material. A ratchet with a permanent handle is fitted on the feed screw, making it possible to drill or ream in very inaccessible places. The principal dimensions are shown in the illustration. One of these drills will be sent on approval to anyone desiring to make a test of its capabilities.



PNEUMATIC DRILL FOR CLOSE QUARTERS.

EQUIPMENT MILEAGE.—Tables just compiled by the Pennsylvania Railroad, Lines East of Pittsburgh and Erie, show that the total freight equipment mileage—the number of miles traveled by all freight cars—amounted in the year 1906 to 1,329,259,529, an increase of 18 per cent. in two years. The passenger equipment mileage was 185,287,826, an increase of 12.4 per cent. in two years, and the locomotive mileage, both freight and passenger, was 120,824,079, an increase of 17.8 per cent. in two years.

Growth of freight traffic, as shown by the figures, was especially large on the Pennsylvania Railroad Division and the Buffalo and Alleghany Valley. The increase in freight equipment mileage on the latter amounted to 33 per cent. in two years. The record of the P. R. R. and B. & A. V. Divisions for the three years ending December 31, 1906, were as follows:

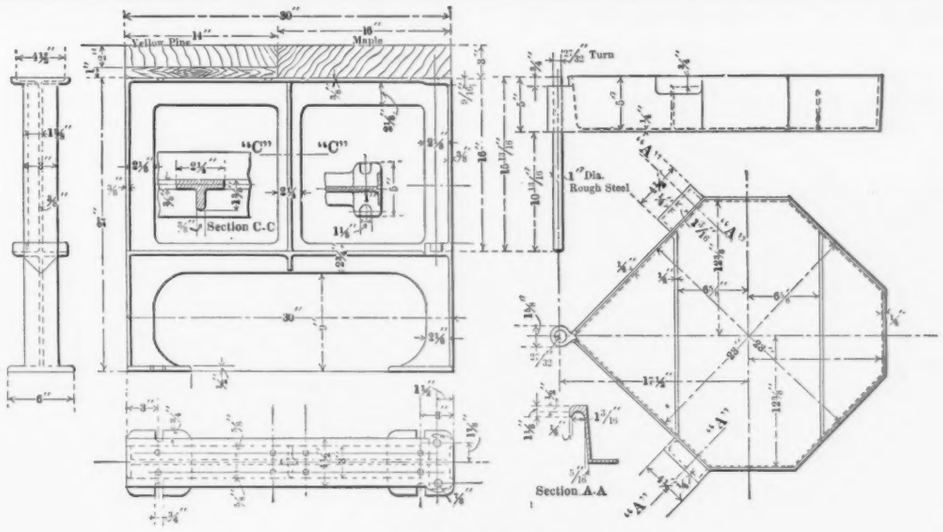
	P. R. R.	B. & A. V.
1904	655,425,683	86,801,849
1905	747,900,477	105,947,065
1906	780,870,162	115,754,503

The folowing figures show the locomotive mileage and the passenger equipment mileage for the three years:

	Locomotive.	Passenger Equipment.
1904	102,530,756	164,907,195
1905	113,533,613	172,181,392
1906	120,824,079	185,287,826

FREE ADVERTISING.—Hundreds of concerns try to get notice in their trade press without giving up any information worth reading. With the fear of competitors in view, they never reason that the competitor who is really alive, and dangerous, and able to use information, will probably get all the data he wants whether they give it out or not. They fail to see that the concern contributing valuable information regularly to technical publications soon becomes known as one conspicuous for its activity and progressiveness. They would like the trade to believe, in effect, that the total result achieved by a high-priced executive, investigating and manufacturing staff the past six months is that:

Thomas F. Jones, president of the American Mill Construction Corporation, visited New York last week on business connected with the company.—*Mr. James H. Collins in Selling Magazine.*



BENCH DRAWER.

BENCH DRAWER.

A bench drawer, far superior to the ordinary type, has been in use in the works of The G. A. Gray Company, Cincinnati, for several years with very satisfactory results. The drawer is of cast iron, swings on a vertical shaft, thus opening easily and swings wide open, making every part of the drawer available and open to inspection without danger of spilling the contents. The drawer was originally designed by Prof. John E. Sweet. The accompanying drawings show a modification of the design as adopted by The Gray Company.

As may be seen, the cast iron bench legs, which are placed about 6 feet, center to center, are designed to take the vertical shafts upon which the drawers swing. The upper part of the shaft is turned to 27-32 in. in diameter and fits in the ⅞-in. drilled hole in the bench casting. The lower end of the shaft is 1 in. in diameter and rests in a slot in a projection or bracket on the leg of the casting. The arrangement of the slot and the manner in which the door operates are such that there is no liability of the lower end of the shaft being displaced. The sides and bottom of the drawer are ¼ in. thick, and if desired may be lined with wood or other material. The bench covering used by The Gray Company consists of 3-in. x 16-in. x 12-ft. maple planks at the front of the bench, and 2-in. x 14-in. yellow pine planks at the rear resting on 1-in. strips placed lengthwise on the castings.

We are indebted to The G. A. Gray Company for drawings and information.

GRAMMAR.—The tendency to place grammar at the head of the list of requirements in contributed matter, or in any prominent place in such a list is really amusing to an editor. The grammar and the spelling of an article are nothing but the paint and polish, which it is perfectly easy to find someone to put on, while the man for whom we are looking is the one who can do the really important work. Grammar is like a man's necktie which, though necessary for the sake of appearances, does little that is really useful. We wish our doubting readers could see some of the manuscript that comes into this office and know some of the sources from which it comes. If our readers imagine that all college professors can write English which would be presentable in type, they are very much mistaken, the fact being that manuscript from such sources requires editorial revision to a degree that they would scarcely believe. And does the editor buy a larger hat when he corrects the manuscript of a professor? No, because the printer and the proofreader even up the matter with him by correcting his manuscript in turn.

There is not one college graduate in twenty—we would put the figure higher if we thought that we would be believed—who can prepare manuscript that he would not himself be ashamed of, could he see it reproduced in type exactly as he prepared it; the queer thing about it being that errors which entirely escape one's eye in the manuscript will stare him out of countenance from the printed page. The niceties of printed English are found in no grammar and taught in no school. The printer and the professional English scholar are the only ones who know them, and in a contest between the two we would lay long odds on the printer winning.—*American Machinist.*

STANDARDIZATION OF LOCOMOTIVES.—It would be absurd and immensely unprofitable to displace all existing engines with new standard ones, for the double reason that the old engines are in a majority of cases able to render good and efficient service, and the new standardized engines would in the course of five years themselves be obsolescent. Moreover, such thorough standardization as hereinbefore indicated will apply in whole to but 30 to 50 per cent. of the engines, although these engines move 75 to 80 per cent. of the traffic. It can only be hoped that standardization will be approximately complete. In the course of time and as experience and recent development dictate, these standard parts themselves must undergo redesign. But it may be hoped that for the greater part the feature of interchangeability will be retained, and the feature of central manufacture in quantities will be one of the governing considerations in design and redesign.—*Mr. H. W. Jacobs in the Engineering Magazine.*

PERSONALS.

Mr. J. J. Curtis has been appointed master mechanic of the Chicago Union Transfer Railway, with office at Clearing, Ill.

Mr. W. W. Thomas has been appointed master mechanic of the St. Louis & San Francisco Ry., at Cape Girardeau, Mo.

Mr. T. F. Carbery has been appointed division master mechanic of the Missouri Pacific Ry. at St. Louis, Mo.

Mr. J. S. Sheafe has been appointed general foreman of the Indianapolis Southern Ry. shops at Indianapolis.

Mr. L. A. Litterer has been appointed road foreman of engines of the A. T. & S. F. Ry. (Coast Lines) at Needles, Cal.

Mr. Wm. Henry has been appointed assistant master mechanic of the St. Louis & San Francisco Ry. at Memphis, Tenn.

Mr. I. C. Hicks has been appointed master mechanic of the Los Angeles division of the A. T. & S. F. Ry., at San Bernardino, Cal.

Mr. P. C. Morales has been appointed acting master mechanic of the Vera Cruz & Pacific R. R., with office at Tierra Blanca, Mex.

Mr. Isaac McKeever has been appointed master mechanic of the L. V. R. R., at Weatherly, Pa., succeeding Mr. Thomas Coyle, deceased.

Mr. Wm. Schlafge, master car builder, has been appointed general master mechanic of the Erie R. R. with headquarters at Meadville, Pa.

Mr. Chas. A. Bingaman has been appointed engineer of tests of the P. & R. Ry. instead of Chas. A. Bingham as noted in our last issue.

Mr. J. T. Johnston has been appointed assistant general boiler inspector of the A. T. & S. F. Ry., with headquarters at Albuquerque, N. M.

Mr. A. B. Todd has been appointed master mechanic of the Valley division of the A. T. & S. F. Ry. (Coast Lines) with office at Richmond, Cal.

Mr. O. R. Hale has been appointed master mechanic of the Torreon division of the Mexican Central Ry., with headquarters at Torreon, Mex.

Mr. N. Greener, master mechanic of the Tremont & Gulf R. R. has been appointed superintendent of motive power, with office at Tremont, La.

Mr. R. T. Jaynes, general shop foreman of the Lehigh & Hudson River R. R., has been appointed master mechanic, with office at Warwick, N. Y.

Mr. A. E. Mitchell has been appointed expert engineer of tests of the New York, New Haven & Hartford Ry., with headquarters at New Haven, Conn.

Mr. E. H. Harlow has been transferred to Albuquerque, N. M., as master mechanic of the first district of the Albuquerque division of the A. T. & S. F. Ry.

Mr. R. G. Long has been appointed division master mechanic of the Missouri Pacific Ry. at Fort Scott, Kans., succeeding Mr. W. C. Walsh, resigned.

Mr. J. R. Bancroft has been appointed general foreman of the shops of the Houston & Texas Central at Houston, Texas, in place of Mr. D. E. Bloxsom, resigned.

Mr. A. R. Manderson has been appointed master mechanic of the Portland & Rumford Falls Ry. at Rumford Falls, Me., succeeding Mr. M. R. Davis, resigned.

Mr. F. S. Guinn has been appointed road foreman of engines of the first district of the Arizona division of the A. T. & S. F. Ry. with headquarters at Needles, Cal.

Mr. G. W. Lillie has been appointed supervisor of the car department of the St. Louis & San Francisco Ry., with office at St. Louis, Mo., succeeding Mr. C. D. Pettis, resigned.

Mr. A. H. Hodges, heretofore general foreman at Brunswick, Md., has been appointed master mechanic of the Cumberland division of the B. & O. R. R. at Cumberland, Md.

Mr. E. A. Westcott, heretofore foreman of car repairs at Kent, Ohio, has been appointed assistant mechanical superintendent of the Erie R.R. in charge of the car department.

Mr. T. Rumney, heretofore assistant mechanical superintendent of the Erie R.R., has been appointed mechanical superintendent, succeeding Mr. George W. Wildin, resigned.

Mr. W. M. Evans, general foreman of the C. R. I. & P. shops at Herrington, Kan., has been appointed master mechanic at Argenta, Ark., to succeed Mr. J. M. McGie, promoted.

Mr. M. J. McGraw, heretofore master mechanic of the Missouri Pacific Ry. at St. Louis, has been transferred to Sedalia, Mo., as superintendent of shops in place of Mr. S. M. Dolan, resigned.

Mr. A. E. Jarrett, general foreman of the L. & N. R. R., at Nashville, Tenn., has been appointed assistant master mechanic at Birmingham, Ala., succeeding Mr. J. P. Fahey, deceased.

Mr. G. J. DeVilbiss, master mechanic of the Newark division of the B. & O. R. R., has resigned to accept the position of superintendent of motive power of the Ohio Central Lines, with office at Columbus, Ohio

Mr. R. H. Rutherford, heretofore master mechanic of the Mexican Central Ry., at Torreon, Mex., has been appointed master mechanic of the Aguascalientes division, with headquarters at Aguascalientes, Mex.

Mr. J. Kirkpatrick, heretofore master mechanic of the Cumberland division of the B. & O. R. R., has been appointed master mechanic of the Newark division at Newark, Ohio., in place of Mr. G. J. DeVilbiss, resigned.

Mr. Maurice Dailey, master mechanic of the Des Moines division of the Chicago Great Western, with office at Des Moines, Ia., has been appointed superintendent of terminals of the Oelwein division, with headquarters at Oelwein, Iowa.

Mr. R. M. Galbraith, formerly general master mechanic of the St. Louis Southwestern Ry., which position he resigned in November, 1899, has been appointed superintendent of machinery of the Kansas City Southern Ry. with heeadquarters at Kansas City, Mo., to succeed Mr. F. Mertsheimer, resigned.

Mr. S. S. Stiffey, superintendent of motive power of the Ohio Central Lines, consisting of the Hocking Valley, the Toledo & Ohio Central, the Kanawha & Michigan and the Zanesville & Western, has been appointed general superintendent of motive power of these roads, with headquarters at Columbus, Ohio.

Mr. Joel Stephen Coffin.—Friends of Mr. Coffin, and he is held in high esteem by a wide circle of acquaintances among railroad men, will be glad to learn of his promotion to the position of vice-president of the Galena-Signal Oil Company. Mr. Coffin was born in 1861, and in 1876 entered the shops of the Chicago & West Michigan Railroad at Muskegon, Mich. In 1880 he started firing on that road and in 1881 was promoted to the position of engineer. In 1884 he took a position as engineer on the Wisconsin Central, and in 1889 was promoted to general road foreman of engines. In 1892 he entered the service of the Galena-Signal Oil Company as a mechanical expert, and in 1897 was made manager of the expert department, which position he has held to the present time. His office will, as before, be at Franklin, Pa.

BOOKS.

Proceedings of the Railway Signal Association for the Year 1906. Volume IX. Published by the Association, 12 North Linden street, Bethlehelm, Pa. 6 by 9 ins. Paper. 342 pages.

This volume contains the proceedings of the two Chicago and the two New York meetings and also of the annual meeting held at Washington, D. C., October, 1906. Several important individual papers were presented, and these with the committee reports and

the discussions form a valuable addition to the literature on this subject.

Proceedings of the Association of Railway Superintendents of Bridges and Buildings. Sixteenth Annual Convention held at Boston, Mass., October, 1906. 6 x 9 ins. 300 pages. Secretary, Mr. S. F. Patterson, Concord, N. H.

In addition to the discussion of standing subjects there are reports and discussions on the following topics: modern coaling stations and cinder pits, fire protection, preservatives for wood and metals, bumping blocks for passenger and freight use, method of watering stock in transit, recent practice in coffer dam work and pile and frame trestle bridges.

Traveling Engineers' Association. Proceedings of the Fourteenth Annual Convention. 1906. Edited by W. O. Thompson, secretary, Oswego, N. Y.

This volume contains the complete papers, together with a discussion thereof, presented at the last annual convention of the association, held in Chicago, August, 1906. It contains valuable papers on the subject of drafting locomotives, tonnage rating, handling of the air brake, Walschaert valve gear, a brief resumé of each annual convention since the founding of the association in 1893, together with the subjects discussed and the photographs of all of the past presidents. There is also included a list of active, associate and honorary members, which now number 587.

Mechanical Engineering Materials. By Edward C. R. Marks. 4¾ x 7 ins. Cloth. 98 pages, 38 illustrations. Published by The Technical Publishing Company, Ltd., 287 Deansgate, Manchester, England. Price, 2s. 6d.

This little book is not intended as an exhaustive treatise on the strength of materials but deals briefly with the properties and treatment in construction of the more common engineering materials. It is intended primarily to assist the user in making a proper selection from the various grades of materials on the market. It includes chapters on cast iron, wrought iron, steel, case-hardening and Harveyizing, and the last two chapters consider copper, brass, bronzes, aluminum and white metals for bearings.

The Science Year Book. Edited by Major B. F. S. Baden-Powell. Published by King, Sell & Olding, Ltd., 27 Chancery Lane, W. C., London, England. 6 by 9 ins., cloth. Price, 5s.

The first part of this book, about 150 pages, is devoted to astronomical data; general information concerning the earth and climatic conditions; physical and chemical notes; metrology; a summary of the progress of science during the past year; a glossary of recently introduced scientific terms and names; directories of scientific and technical periodicals, British public institutions, offices and universities and British, American and Canadian scientific societies; and a biographical directory of scientists. The remainder of the book, about 400 pages, is a diary for 1907, although copies of the book may be obtained without the diary, if desired.

The Peabody Atlas. By A. Bement. 16¾ x 18 ins. 149 pages. Cloth. Published by the Peabody Coal Company, Chicago. Price, $5.00.

This volume contains much valuable information and interesting data relative to the bituminous coal mining industry of the central part of the country, including the States of Missouri, Illinois, Iowa, Indiana, Michigan, Ohio and part of Kentucky. It contains numerous colored maps showing the coal areas of this section, upon which is shown the location of each individual mine, together with its output, operator, etc., the railroad lines serving them and similar valuable information. There is much interesting data on the chemical, geological and engineering features of coal mines. A chapter is devoted to smokeless furnaces and smoke suppression, illustrated with photographs and sectional drawings showing the latest improved methods. This work will be found of much value to any one interested in this subject.

A Manual of Round and Square Bars, Turnbuckles, Clevis Nuts and Forgings. Flexible leather binding. 4 x 6¾ ins. 80 pages. Published by the Cleveland City Forge & Iron Company, Cleveland, Ohio.

This little handbook contains a considerable number of useful tables and information relating to round and square bars, turnbuckles and clevis nuts, and other forgings as made by the above company. It is intended as a manual for the use of engineers, car builders, architects and mechanics. Eleven pages are devoted to turnbuckles, and this includes such information as tables of dimensions, weights and price lists and illustrated descriptions of the various types. Following this is information concerning clevis nuts; car forgings, including brake and push rod jaws and drawbar yokes; counter and lateral rods; lateral and bridge chord pins with reversed screw ends for round bars; standard screw threads; dimensions of bolts and nuts; tables of information concerning square and hexagon nuts, washers and bolts; standard decimal gauge; wire and sheet metal gauges; weight and areas of square and round bars; decimals of a foot for each 1/64 of an inch; and decimals of an inch for each 1/64. In addition to a very complete index there is an illustration of the largest turnbuckle ever made, which weighed 768 lbs. and was tapped for 5-inch rods. There are also about 25 pages of cross-section note paper. It is presumed that copies may be had free, upon application to the above company.

Locomotive Performance. By W. F. M. Goss, M. S., D. E., Dean of Schools of Engineering, Purdue University. 6 x 9 ins. 439 pages, 229 illustrations. Cloth. Published by John Wiley & Sons, 43 East 19th Street, New York. Price, $5.00.

For a number of years the Engineering Laboratory of Purdue University has concerned itself with problems relating to the performance of locomotives, and the results of its researches have from time to time appeared in the proceedings of various scientific and technical societies. This process of publication has extended over a period of fourteen years, and has run through many different channels, with the result that the record now exists in widely scattered parts, which are often difficult of access and, therefore, of limited usefulness. The purpose of this volume is to combine the most important of these results with other material not before published, and thus make a permanent and accessible record of the work of the laboratory. The volume is designed as a record rather than a text, though it is hoped that it will prove of interest and value to any who wish to increase their acquaintance with the action of steam locomotives.

The book in addition to containing a brief review of the many important tests made on this plant with references by which the complete report on each may be obtained, together with the results of practical value, also gives a historical account of the Purdue testing plants and a complete description of the plants and locomotives on which tests were made. A final chapter is given in which the practical value of the results in making estimates of locomotive performance is clearly illustrated. This volume, taken in connection with the results obtained on the Pennsylvania R. R. Testing Plant at St. Louis, makes available for convenient reference all of the important data from accurate tests on American locomotives.

Proceedings of the Railway Storekeepers' Association. Third Annual Meeting held at Chicago, May, 1906. Cloth. 6 x 9 ins. 212 pages. Secretary, Mr. J. P. Murphy, Box C, Collinwood, Ohio.

The president reported that the membership had been increased to 184, an increase of very nearly 60 per cent. since the previous meeting. A number of valuable papers were presented and, what is more important, they were all freely discussed. This was especially true of the first subject on the program: "To what extent is the modern railroad storehouse a factor of economy?" Among the other topics were: Tidiness in the storage of, and caring for, material and its effect upon the future storekeeper; requisitions—the best and most simple form, also the method of recording and filing them; requisitions—the shortest method of handling at the general storehouse; rules governing division or terminal storekeepers; method of checking intake and output of material delivered to the shops; manufactured material—method of ordering and receiving in the company's shop; storehouse furniture; checking receipt of oils and paints; method of allowing scrap credit; stock record—simple and practical system of keeping; locomotive firebrick and asbestos lagging; railroad storehouse organization; storehouse economy, etc. The proceedings also include reprints of two papers, read before railroad clubs during the year, and the discussions which took place. One of these, "A True Perspective of the Supply Department," was presented by Mr. Geo. Yeomans before the Western Railway Club; the other, "The Railway Store Department and its Relationship to Other Departments," was presented by Mr. J. H. Callaghan before the Canadian Railway Club. In addition to the drawings and photographs reproduced in connection with the different papers there are twenty-five half-tone illustrations showing various features in connection with the storehouses on the Santa Fe, Canadian Pacific, Lake Shore, New York Central and the North-Eastern of England. The as-

sociation is to be congratulated, not only on the high quality of the material in the proceedings, but upon its careful arrangement and the very neat and businesslike appearance of the volume.

CATALOGS.

IN WRITING FOR THESE CATALOGS PLEASE MENTION THIS PAPER.

STEAM TURBINES.—The Kerr Turbine Company, Wellsville, N. Y., is issuing Bulletin No. 2, illustrating and describing the Kerr steam turbine blower. Details of the turbine are illustrated and the complete apparatus is very carefully described.

LUBRICATING OIL STORAGE.—S. F. Bowser & Company, Fort Wayne, Ind., is issuing a small folder illustrating several different arrangements and types of cabinets for oil storage suited to special conditions. These employ the Bowser self-measuring pump.

GAS PRODUCERS.—The Wellman-Seaver-Morgan Company, Cleveland, is issuing circular No. GP-1, which carefully illustrates and describes the Hughes continuous gas producers. It contains, in addition to the description, several comparative statements of investment and cost of operation of different types of gas producer plants.

DIRECT CURRENT MOTORS AND GENERATORS.—Bulletin No. 1057 from the Allis-Chalmers Company, Milwaukee, Wis., describes their type K motors which are especially designed to meet the requirements for individually driving machine tools of all kinds. A number of applications to machine tools are illustrated. These motors operate exceptionally well as generators.

MACHINE TOOLS.—The March issue of the Progress Reporter published by the Niles-Bement-Pond Company describes and illustrates the following tools which are adapted to railroad shop work: Pratt & Whitney 16-in. toolmaker's lathe, planers with pneumatic clutches, Pond 28-in. turret lathe adapted for both chuck and bar work, two spindle cylinder borer, 600-ton hydraulic wheel press, double axle lathe, Pratt & Whitney improved tube expanding tool and a two spindle drill for locomotive work.

ELECTRICAL APPARATUS.—The General Electric Company is issuing several new bulletins of interest to railroad men, those received being as follows: Bulletin No. 4486 on the CQ motor adapted for individual and group driving of machine tools; No. 4484 on railway signals of the two and three position type, electrically operated; No. 4481 on signal relays and No. 4482, a guide to the design of medium and small capacity central station switchboards.

CAREY ROOFING.—The Philip Carey Mfg. Co., Cincinnati, O., is issuing an attractive catalog descriptive of the Carey roofing. The materials entering into its composition are each considered and the favorable results accompanying the long time tests of this roofing under the most disadvantageous circumstances are explained by the fact that none but the best materials are used, which together with good workmanship and special methods produce a flexible fire and weather resisting product.

HIGH SPEED STEAM ENGINES.—The American Blower Company, Detroit, Michigan, is issuing catalog No. 206, which is arranged and printed in a very neat and artistic manner and contains complete illustrations and description of several different types of small high speed engines, these being in the most cases automatic and designs are shown for both high and low pressure. They will run continuously for three months or more with no attention other than to fill the sight feed cylinder lubricator, and some have run as long as twenty-four months. Designs are shown in both the single and double cylinder type for driving blowers, electric generators or centrifugal pumps.

ALTERNATING CURRENT GENERATORS.—The Crocker-Wheeler Company, Ampere, N. J., is issuing Bulletin No. 74 which is confined exclusively to a description of alternating current generators direct driven by steam, gas or oil engines. The details of machines are illustrated and each carefully described. A number of illustrations of recent installations are also included. One of the marked peculiarities of these alternators is their ability to operate in parallel, and it is stated that it was largely for this reason that the California Gas and Electric Corporation installed three 4,000 k. v. a. machines in its San Francisco plant. These are the largest generators ever built for gas engine drive.

AIR-COOLED ELECTRIC TOOLS.—The Chicago Pneumatic Tool Company is issuing Catalog No. 21 which covers the complete line of electric drills, grinders, drilling stands, magnetic old man, hoists, etc., manufactured by it. The electric machines are of the Duntley air-cooled design and the catalog is profusely illustrated with half-tone engravings, showing the different tools in use. It also contains sectional drawings which show the construction and arrangement of the 1, 2 and 3 motor types of drills. These drills are manufactured for use with both direct and alternating current and in practically any size desired.

TEN-WHEEL TYPE LOCOMOTIVES.—A pamphlet just issued by the American Locomotive Company illustrates and describes ten-wheel locomotives weighing over 150,000 pounds. It is a sequel to the pamphlet issued last month by the same company describing lighter designs of this type. Thirty different designs are illustrated and the principal dimensions of each given. These range in weight from 152,000 to 201,000 pounds and are adapted to a wide variety of road and service conditions. This is the sixth of the series of pamphlets which is being issued by this company and which now includes pamphlets on the Atlantic, Pacific, Consolidation and Ten-Wheel types of locomotives.

NOTES.

PRESSED STEEL CAR COMPANY.—Mr. F. B. Bissell has obtained a long leave of absence from the above company and sailed on January 22 for a trip around the world.

WARNER & SWASEY COMPANY.—Mr. Thomas Farmer of Detroit, Mich., has accepted a position with the above company as its western representative. The general office of the company is at Cleveland, Ohio.

FALLS HOLLOW STAYBOLT IRON FOR FRENCH LOCOMOTIVES.—The Paris-Orleans Railway Company of France has specified Falls Hollow Staybolt iron for the 20 DeGlehn compound locomotives now being built by the Baldwin Locomotive Works.

CRANE COMPANY.—This company announces that it now has its new steel foundry in full running order. In this department steel valves and fittings will be a specialty and the facilities are such that promptness in filling orders for these goods is assured.

STANDARD COUPLER COMPANY.—This company announces that Mr. Edmund H. Walker, who for the past two years has been assistant to the president, has been promoted to the position of general sales manager, with office at 160 Broadway, New York.

KENNICOTT WATER SOFTENER COMPANY.—This company announces that it has recently received an order from the Baltimore & Ohio Railroad Company for a softener, having a treating capacity of 40,000 gals. per hour, which is to be installed at East Side, Philadelphia, Pa.

AMERICAN STEAM GAUGE & VALVE MFG. CO.—It is announced that Mr. R. M. Turner, heretofore eastern representative, has been appointed manager of the publicity department of the above company. Mr. C. H. Mosher, who has had several years' experience in this line of work, will succeed Mr. Turner as eastern representative. The address of the company is 208 Camden St., Boston, Mass.

CROCKER-WHEELER COMPANY.—It was announced at the officers' and branch managers' convention of the above company, held January 23 to 26, that the company had done more business during 1906 than any other year since its foundation eighteen years ago. Among the specialties that made phenomenal successes during the year were alternating current generators of large capacity and direct current motors for machine tools.

NEW MILEAGE TICKET.—The Pennsylvania Railroad announces that the new twenty dollar 1,000 mile tickets placed on sale September 1, 1906, have become so popular that it is difficult to keep up the supply. These tickets are good for one year and for the passage of holder and any number of other persons on any of the lines of the company east of Pittsburgh and Buffalo. These tickets are particularly popular with business houses which keep a force of men on the road.